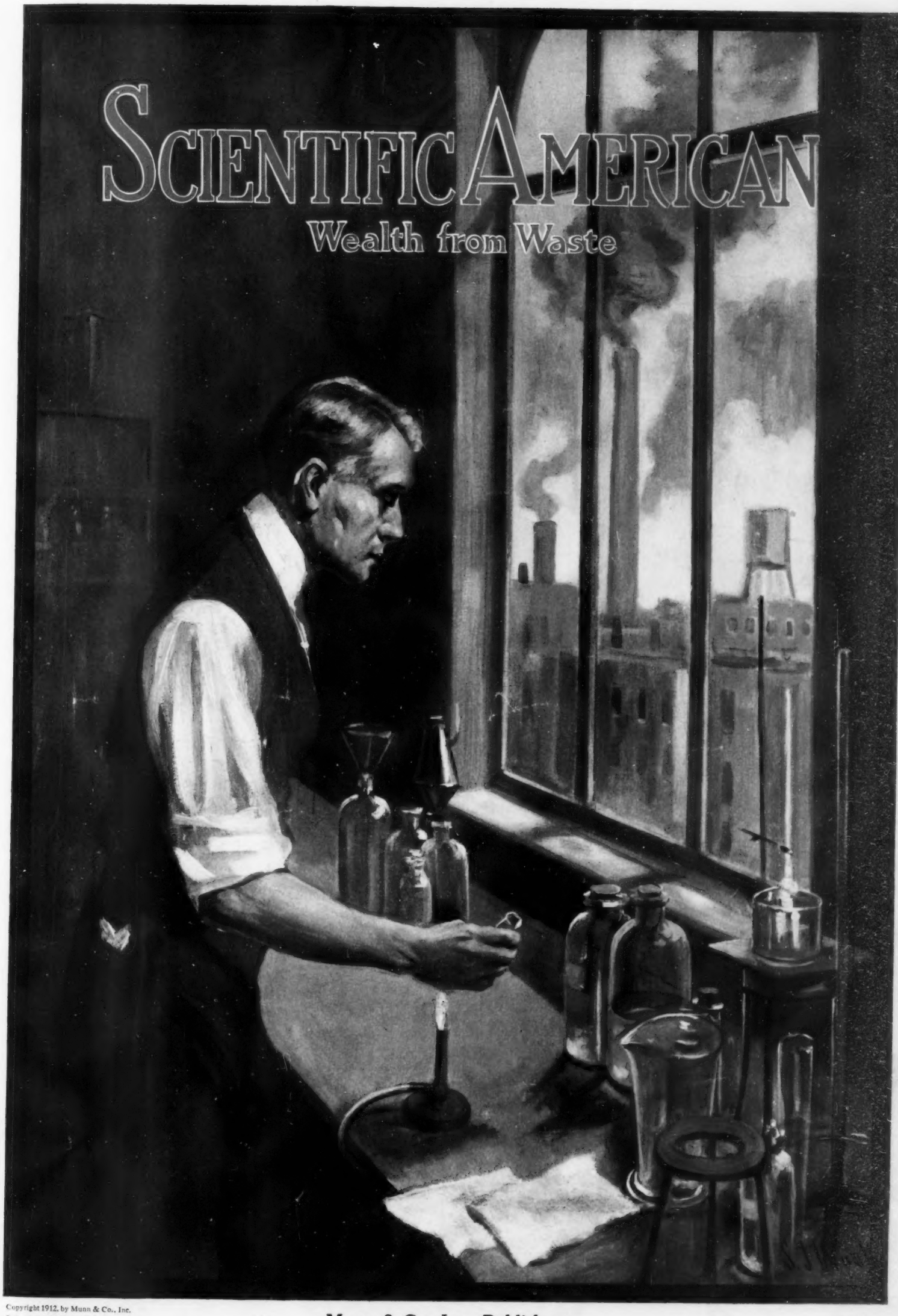
SCIENTIFIC AMERICAN

Wealth from Waste



Vol. CVI. No. 24
June 15, 1912

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New York, N. Y.

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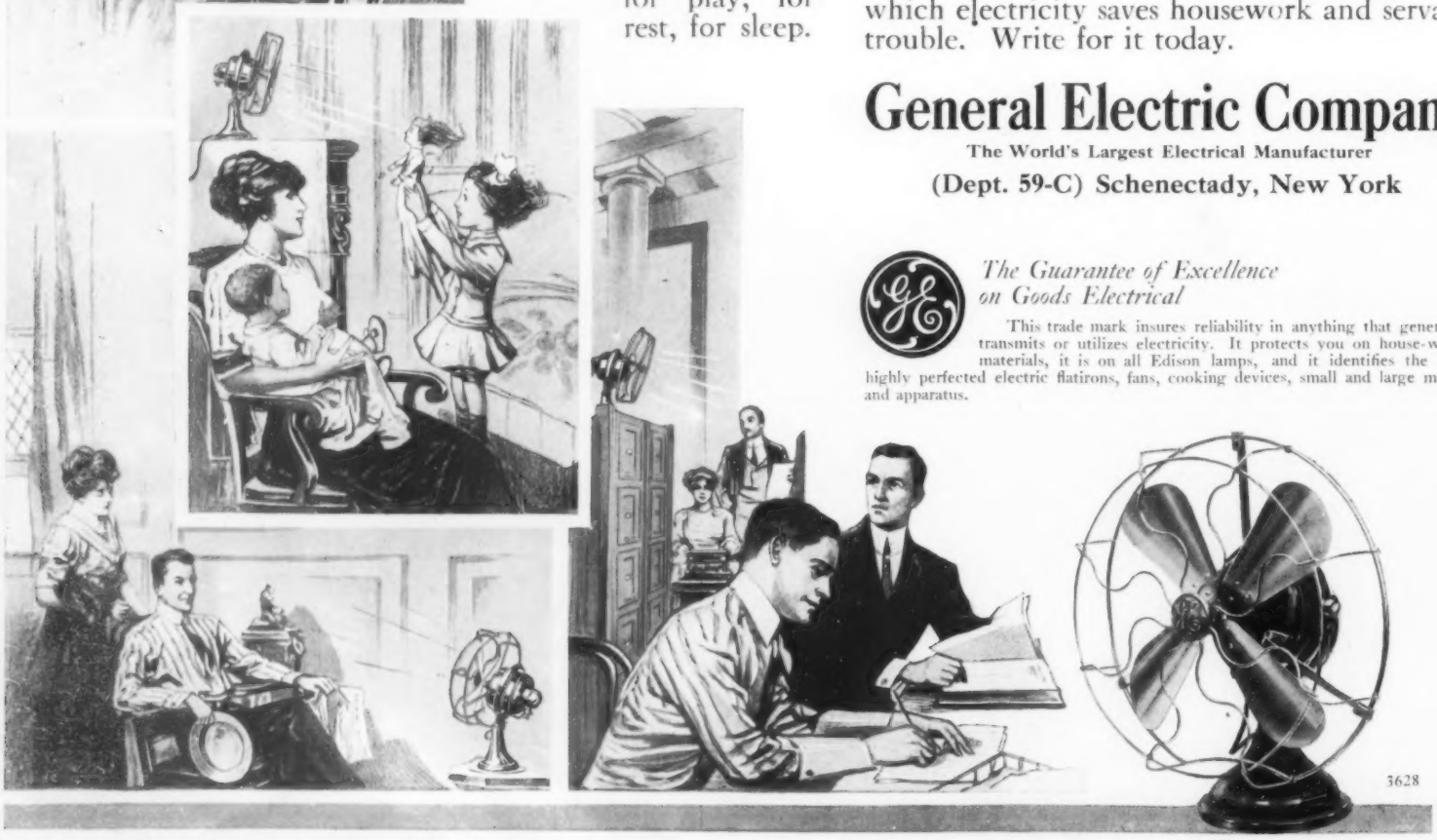

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SIXTY-EIGHTH YEAR

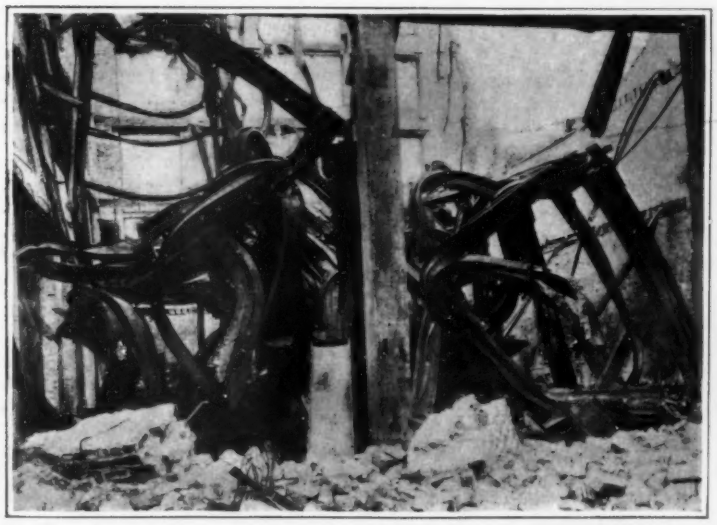
SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

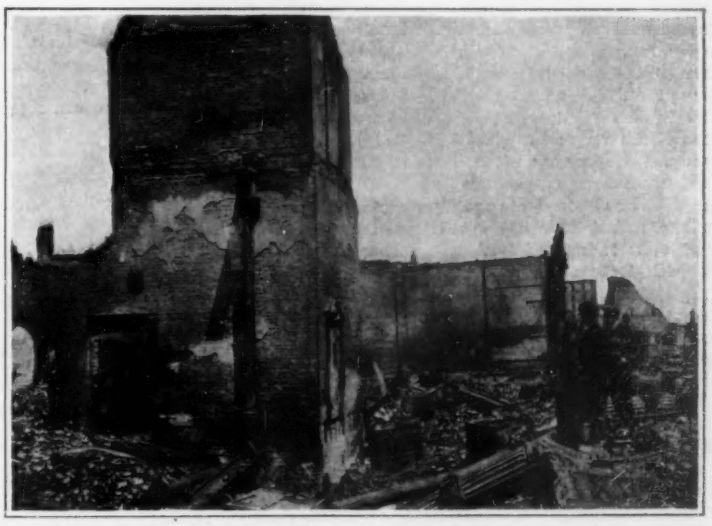
VOLUME CVI. NUMBER 24.] NEW YORK, JUNE 15, 1912 [15 CENTS $3.00 A YEAR

A serious oil-tank fire on a pier. Many an oil-tank is situated along a water-front, surrounded by wooden wharves, sheds, warehouses, and a cluster of low-lying wooden structures. It is not difficult to picture how rapidly a conflagration would spread under these conditions. Gradually we are growing to realize that wharves and wharf sheds should be made fireproof.

The burning of an orphan asylum. According to the National Fire Protection Association, "the average American city is full of fire traps. Buildings of great areas without fire cutoffs, with large floor openings, with unprotected windows and with very combustible contents are too numerous to prove the exception to any rule."

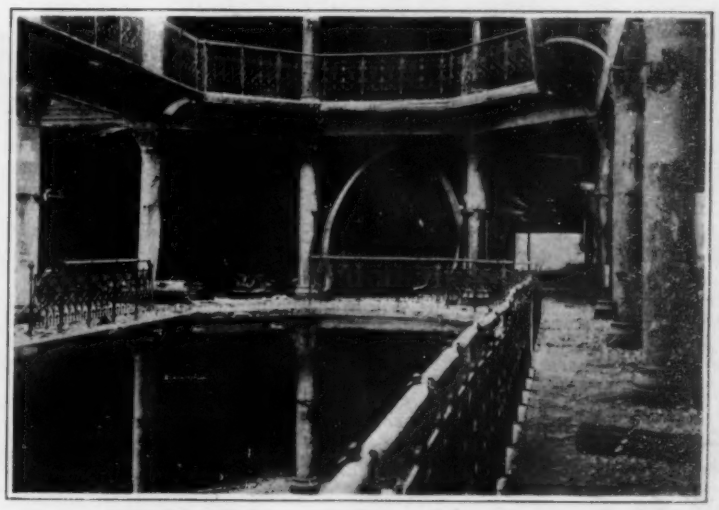


Steel columns and beams twisted in a fire. The fire danger will always be with us until real fireproof construction becomes the rule and not the exception. It frequently happens that a man who erected a building a dozen or more years age according to the best fireproof practice of the day now finds himself with a structure on his hands that is considered unsafe.



The mere fact that a structure is built of stone or brick does not mean that it is fireproof. Filled as it frequently is with highly combustible material, it is easily converted into a gigantic stove. One by one the walls crumble, burying beneath them tons of valuable property and sometimes a dozen firemen.

We shall have conflagrations in the future until the city authorities refuse to allow a man to erect a building that is a menace to the entire community. Our fire-loss will be reduced in proportion to the number of completely fireproof buildings that will be henceforth erected.



The interior of a theater after a fire. Many theaters are conflagration breeders. Fire travels through them rapidly and under certain conditions resists the efforts of the best fire department. The vast open auditorium is converted into a huge furnace.

THE ENORMOUS FIRE WASTE OF THE UNITED STATES.—[See page 541.]

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Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Life-like but not Living

SEVERAL years ago the papers announced that a physicist working in the Cavendish Laboratory at Cambridge had succeeded in producing living things by the action of radium upon bouillon. At that time much less was known about radium than is known to-day, and we were ready to believe almost anything unbelievable about this wonderful substance; but even then it did not take the scientists long to discover that Burke's "radiobes" were not living things at all. Indeed, the very same phenomena had been observed over a year previous by the French physiologist Dubois, who recognized that they were not living things. Dubois had obtained his radiobes without the use of radium, and he has since shown that they do not depend upon radium in Burke's experiments. Being a biologist, Dubois saw that although there are many things that behave in certain respects *like* living things, they are not on that account to be classed as living; and when we can at will reproduce certain of the phenomena of life, we are not to claim that we have created artificial life.

By placing some barium chloride upon the surface of an organic jelly, there are made to appear a large number of tiny corpuscles which undergo peculiar movements; these enlarge to a certain size and then stop growing, resembling in this respect the behavior of microbes. These corpuscles divide and form groups resembling a mulberry; sometimes corpuscles fuse together. At the point where a corpuscle is in contact with the jelly, there appears a growth made up of a mass of very minute roundish bodies which he calls "microbioids," or little life-like bodies. These he has obtained in jellies that were treated with various antiseptics. In some preparations the use of lime soap has brought out the development of structures resembling cells with nuclei in the process of division. Prof. Dubois does not claim that he has created artificial life, but he points out that these microbioids resemble living things in their manner of growth, in the character of their movements, in the appearance of cell-division, in their general structure, and even in the manner of fusing or conjugating. Finally they become crystallized, passing from the active state to the dead condition.

In laying emphasis on the complexity of life and on the fact that each characteristic of life is duplicated by well-known non-living processes, Dubois guards himself against the charge of sensationalism, and his work thus receives more serious consideration from other scientists than the work of such experimenters as Burke or Leduc.

Mares' Nests in Atmospheric Optics

SOME months ago the SCIENTIFIC AMERICAN called attention to a particularly fatuous habit to which scientific journals are addicted, viz., that of publishing more or less crude descriptions of the individual occurrences of certain optical phenomena of the atmosphere, which are treated by the writers as isolated cases, no attempt being made to bring them into relation to the existing body of knowledge concerning this group of meteors.

For example, a certain person sees a solar halo—not necessarily an uncommon one, except in relation to his individual experience—and, much excited over the, to him, novel spectacle, immediately sends a detailed account of it to a scientific periodical. The amazing part of the proceeding is this—that in nine cases out of ten, the observer not only is entirely unacquainted with atmospheric optics, but does not take the trouble to consult the authorities on this subject in order to find out whether the spectacle he has witnessed is one of which science has taken cognizance. Most astonishing, however, is the fact that the journal publishes his communication without editorial revision or comment; thus leaving the majority of readers, themselves unfamiliar with atmospheric optics, completely in the dark as to whether the phenomenon described is something unheard-of, or rare, or common, or commonplace!

Not a week goes by that one or more articles of this sort do not come to our notice; some of them so astonishing in their *naïveté* that one might almost describe them as medieval—for time was when every occurrence of a photometeor a little out of the ordinary was described as a "sign in the sky," fraught with direful meaning, by monkish chroniclers, who were not more blissfully ignorant of its "woof and texture" than are a host of writers in this twentieth century.

In the *Quarterly Journal* of the Royal Meteorological Society for January, 1912, will be found two striking examples of the kind of literature that we have been describing.

If a sailor, having no knowledge of botany and unprovided with botanical books, should undertake to describe the flora of an island on which he had once been shipwrecked, and if his description should appear, unedited, in a botanical journal, we should have a tolerable parallel to the case of an article by Walter Larden, M.A., on solar halos and Brocken specters seen by him in the Alps. Even in the crude form in which they are presented, Mr. Larden's observations have scientific value; but their value would have been many fold greater if, before writing his memoir, the author had taken the trouble to compare them with the generalized accounts of such phenomena to be found in standard reference books. In a foot-note the author mentions that "some years later" he was lent a copy of Bravais' "Mémoire sur les Halos." It is evident, however, that he derived little profit from this work, and that he was quite unaware of its being a fundamental and authoritative treatise, which has fixed the classification and terminology of halos for all time. Of Pernter and Besson he had apparently never heard.

In the same number of the *Journal* appears a brief note from a well-meaning contributor—who does not claim to be a scientific man, and may therefore be pardoned for discovering scientific mares' nests—which bears the alluring title, "Remarkable Rainbow." The phenomenon described really *was* a rainbow; for so much we may be thankful, since rainbows, halos and coronas often get sadly mixed in ostensibly scientific literature. If, however, the editor of the *Quarterly Journal* thinks that a perfectly normal and regular example of the supernumerary rainbow is "remarkable," in the sense of being exceptional, we would suggest that he scan the eastern sky after the very next summer afternoon thunder shower that may come his way.

Peruvian Guano

ALTHOUGH Peruvian guano has been extensively replaced by other fertilizers in the world's markets, this product is still one of the important assets of the South American republic, where its value has been appreciated from the earliest times. The guano deposits were, in fact, exploited and protected by the Inca kings; though it was not until Humboldt carried specimens to Europe that the world at large became acquainted with it, and only since the year 1840 has it been extensively exported. The total shipments since that year amount to 11,000,000 tons.

Guano is formed by the deposits of millions of seabirds, of many species, that frequent the islands and coasts of western Peru. A recent report from Consul-General Robertson, stationed at Callao, sets forth the present state of the industry. Years ago the richest deposits were those of the three Chincha Islands, where in places the guano lay to the depth of 100 feet. The southernmost of these islands alone has yielded 5,000,000 tons. The Chincha deposits are now nearly exhausted, the most valuable deposits to-day being those on the islands of Lobos de Tierra and Lobos de Afuera, off the northern coast of Peru. Many other islands, however, are very productive. About 60,000 tons are annually exported, while 30,000 tons are used in Peru. In 1890 a concession was granted to the Peruvian Corporation, giving that company the exclusive right to export guano from Peru up to 3,000,000 tons. The company has taken advantage of this privilege to the extent of 1,200,000 tons.

In 1909 a federal decree divided the guano deposits along the coast into two zones; the Peruvian Corporation was to limit its operations to the coast north of Callao and to the Ballestas Islands in the south, while all other deposits were to be exploited by a company which was to sell guano only to the agriculturists of Peru, at reasonable prices. The government would be glad to stop the exportation of guano altogether, reserving it for the use of its own people, and it is proposed to buy back the rights granted to the Peruvian Corporation.

Wise measures have now been adopted to conserve and perpetuate the supply of guano. A vigilant inspection service is maintained; a close season is observed during the incubation period of the birds; a rotation is followed in working the deposits; and the seals that destroy the guano birds are vigorously hunted.

The Human Side of Great Scientists

THERE is among many a misconception of the man of science as a morally and emotionally shriveled specimen who remorselessly sacrifices romance and poetry and human ties in crassly materialistic pursuits. The comparison of this misconception with the behavior of many typical scientists is distinctly ludicrous. Take, for example, the famous X Club.

This was essentially a dinner club; the members who attended its first meeting were Hirst, Spottiswoode, Tyndall, Frankland, Huxley, Hooker, Busk, Avebury, and Spencer. Later members were Darwin and many another of those amazing nineteenth century giants. "It has happened," observed Huxley, "that these cronies had developed into bigwigs of various kinds, and therefore the club has incidentally—I may say accidentally—a good deal of influence in the scientific world." Huxley once overheard two members of the Athenaeum: "I say, do you know anything about the X Club?" "Oh, I have heard of it." "What do they do?" "Well, they govern scientific affairs; and really, on the whole, they don't do it badly."

Nevertheless, a guest of this club must have been shocked and saddened by the frivolity obtaining among its members. There were no rules, save the unwritten law not to have any. But skeletal minutes were kept, as "Talked politics, scandal, and the three classes of witnesses: liars, — liars, and experts." Excursions were organized for the members and their wives, as recorded by the algebraic notation "x's + y'vs;" the "x's" of the outings to be paid by the "x's." It was suggested in the beginning to name this club the "Blastodermic," that being the part of the ovum in which the rudiments of future organism first appear; apparently "x" was eventually chosen because it stood for the unknown quantity, and so committed the club and its members to nothing. In this coterie the observation of Herbert Spencer seems to have been lived up to: "It is a great mistake for adults, and especially those who work their brains much, to give up sports and games. The maxim on which I have acted is, be a boy as long as you can."

Consider also Galton, well termed the Pepys of modern science; the autobiography of the great eugenist simply drips with geniality, unction and *Gemüthlichkeit*. Consider how on one occasion he put on his best clothes, to give himself confidence at a meeting of the Royal Society, soon after he had addressed "a multitude of questions about themselves and their families, a few of which touched upon religion and other delicate matters."

During an exploring expedition in Southwest Africa Galton visited the Ovampas. "I did much to make myself agreeable, investing King Nangoro with a big theatrical crown that I had bought in Drury Lane for some such purpose. But I have reason to believe that I deeply wounded his pride by rejecting a present he had to offer in return. His niece appeared in my tent, raddled with red ocher and butter, and as capable of leaving a mark on anything she touched as a well-inked printer's roller. I was dressed in my one well-preserved suit of white linen; so I had her ejected with scant ceremony."

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Electricity

International Radio-telegraphic Convention.—The Second International Radio-telegraphic Convention opened on June 4th, at the headquarters of the Institute of Electrical Engineers, London, England. The delegates are all experienced men and the probable outcome of the convention will be many amendments to the regulations adopted at the Berlin convention, six years ago. In the intervening time wireless telegraphy has developed so rapidly that new regulations are badly needed. It is probable that the convention will be in session during the entire month of June.

Looking Forward from 1878.—In a report of the general meeting of the Bombay Gas Company of thirty-four years ago one of the participants, who had shortly before attended an exhibition of the electric light, stated that this light was not one "which any man could put about his house and leave in the care of his servants. There could be no store of electricity, and the instant the engine ceased to work from any cause or accident all the lights would be gone." Another attendant at the meeting "was quite ready to admit that at some distant day electric lighting might become general; but it might be that at some remote period men might fly. . . . All these things might be possible, but they were a long way off."

Regulation of Wireless at Sea.—The Alexander bill, which provides for the regulation of wireless telegraphy at sea, has passed the House and at present writing is before the Senate. It requires every vessel navigating the ocean or the Great Lakes and carrying fifty or more persons, whether passengers or crew, to be equipped with wireless telegraph apparatus, with a range of at least 100 miles, day or night, under all conditions of atmospheric disturbance when it is safe for the operator to work. Two or more operators are required so that one shall be on duty at all times while the vessel is being navigated. The wireless telegraph apparatus must be operated by an auxiliary power supply, wholly independent of the main electric power plant of the ship.

Electrical Sea Pilot.—At a recent meeting of scientific men in Washington, D. C., the devising of a plan for protecting ships from collision was requested. A tentative plan for this purpose is suggested, in the form of a boat leading the ship and connected with the ship by an electric cable containing wires which supply power for the pilot's propelling motors and wires for transmitting automatic signals to the ship, the steering of the boat to be automatically assisted by the gyroscopic action of the motors. It is planned to install the generating set which supplies power to the pilot on the upper deck of the ship, and to provide both steam and gasoline engine drive for it, so that in case of wreck the ship's wireless telegraph and lighting service can be continued up to the last moment.

Electricity in the Printing Office.—The introduction of electric service has improved the operation and economy of the printing office at least as much as any mechanical plant, and printers are taking more and more kindly to the individual electric motor drive and to electrically heated type-metal pots for the linotype machines. Individual drive saves loss of energy in intermediate shafting, gives a greater number of impressions per hour, thanks to the uniform speed attainable, gives complete control in starting, stopping and regulating the speed, and economizes power by the ability to run any machine independently and by allowing any machine to be operated for a short or long period with no expense for current except during the actual running of the machine. In a new system of motor drive a single field-controlled motor operates the equipment over the entire range of speed required. A single gear connects the motor to the press, and three-button control stations to start, accelerate, slow down, and stop and lock are placed at the pressman's hand.

The Great Transmissions on the Pacific Coast.—Some striking figures are presented of the centralized generation, transmission and distribution of electrical energy by a single company in California owning property and operating in thirty counties representing an area exceeding the combined area of the New England States except Maine. This system operates over a territory of 38,000 square miles, and distributes about 400,000,000 kilowatt-hours per year. It has very nearly 1,200 miles of 60,000-volt, 60-cycle circuits, and about 400 miles more operating at less than 60,000 volts. Its ten hydraulic plants have an aggregate rated capacity of about 67,000 kilowatts, and its three steam plants have an aggregate rated capacity of a trifle more than this. The development of the electric service industry in central California is substantially the history of the growth of the State in population, agriculture, mining, and manufactures for the past fifteen years. Separate plants in scattered localities have been consolidated into a vast network of central station service, utilizing the natural resources of the State, combining plants and lines, and standardizing operating methods and administration.

Science

A University in Siam.—The King of Siam has approved the scheme of establishing a "University of Bangkok." It will include eight faculties, viz., arts, medicine, law, engineering, agriculture, commerce, pedagogy, and political science.

A Simple Pole Finder.—Two thin wires are attached to the two poles of a direct-current system and placed near one another in the flame of a match or a candle. When the current is now turned on it will be found that carbon in form of soot is being deposited on the cathode. This deposit will grow steadily, forming a kind of trunk with fine branches. The potential necessary must however exceed 12 volts.

Testing the Freshness of Milk.—A reagent is made by diluting 0.1 cubic centimeter of a saturated alcoholic solution of methylene blue with 70 cubic centimeters of water. Of this solution 1 cubic centimeter is mixed with 50 cubic centimeters of the milk to be tested, whereupon 30 cubic centimeters of alcohol is added. The mixture is maintained at a temperature of about 37 deg. Cent. and exposed to light. If the milk is not fresh the color of the mixture is discharged within 30 minutes.

Hong Kong University.—The formal opening of Hong Kong University took place on March 11th with elaborate ceremonies under the direction of the retiring governor of the colony, Sir Frederick Lugard. This institution for the education of Chinese youths was founded and endowed by a number of British, Parsee and Chinese gentlemen, and is under the control of the government of Hong Kong. The building was given by the late Sir Hormusjee Mody, a Parsee merchant of Hong Kong. The faculty is mainly British.

A Monument to French Science in Ecuador.—The famous expedition of the French academicians Bouguer, La Condamine and Godin, in the eighteenth century, to measure a degree of meridian in a region of the Andes that is now part of Ecuador, and the geodetic mission sent by France to the same country in 1900, are to be jointly commemorated in a fine monument at Quito, already in course of construction. The Ecuadorean government gave the site and subscribed $2,000 to the enterprise. Additional funds are being raised by popular subscription in Ecuador and France.

Photographs on Gelatine for Lantern Slides.—An ingenious process, discovered by Prof. Paul Askenasy, will, if it proves successful, become of great use to scientific and other lecturers. Instead of photographing the objects intended for projection on glass in the usual way, he prints them on a film of clear gelatine, which is then sandwiched between two plates of thin glass and used as a lantern-slide. A publisher in Halle, Germany, announces that he will supply on application what he calls "filmodiatypes," made by this process, from illustrations of any books published by his firm.

Climbing the Washington Monument.—A few weeks ago a steeple jack caused considerable excitement in Washington by scaling the walls of a Pennsylvania Avenue hotel to a point just below the projecting cornice. Since then thousands stood on the wet ground for hours one morning after a hard night's rain on the monument grounds and thousands more gazed from windows, house tops and other points of vantage at what appeared to be a man on the flat side of the Washington monument about two-thirds up. Many were sure they saw it move. After hours it was determined that it was only a wet spot left by the rain.

Edibility of Antarctic Animals.—Dr. Lionville of the "Pourquoi-Pas" recently described to a French audience —always interested in gustatory matters—the character of the fresh meat obtainable in polar regions. The birds taste, *Le Monde Illustré* quotes him as saying, exactly like an unbled duck which has been thoroughly steeped in cod-liver oil. The seal evokes somewhat the idea of boiled beef; it is insipid with a marked flavor of fish. The various species of whales are of diverse value. Europeans find it impossible to swallow the jubarte, though the Japanese eat it willingly. The rorqual is very good for twenty-four hours; its meat is pale and oily, recalling veal. The fin whale is exquisite, like veal of the first quality; unfortunately it, too, lacks in keeping qualities.

A New Method for Determining Fat and Salts in Butter.—In a circular just issued by the Bureau of Animal Industry of the Department of Agriculture a new test for fat and salt in butter is described. This test was invented by Roscoe H. Shaw, chemist in the Dairy Division, and is especially designed for use in creameries. It places in the hands of practical creamery men a simple, rapid and accurate method by which can be determined the percentage of fat and salt in butter. In connection with one of the reliable moisture tests already in use, this test makes possible the complete analysis of butter right before the churn. The new test will probably not require more than five dollars' worth of apparatus besides that already on hand in most creameries. The same centrifuge is used as in the Babcock test, and the same acid.

Aeronautics

A Glenn Curtiss Aeroplane Launcher.—A launching apparatus for aeroplanes has been patented (No. 1,027,242) by Glenn H. Curtiss of Hammondsport, N. Y., in which an aeroplane supporting device in the form of swinging arms is mounted on a suitable mount and means are provided for imparting at a variable speed an angular throw to the supporting device.

A New Zeppelin Record.—The new military airship "Zeppelin III" arrived at Hamburg on June 1st at 9:35 o'clock in the morning, having covered the course from Friedrichshafen to Hamburg, approximately 450 miles, in ten hours and twenty-five minutes. Count Zeppelin himself piloted the dirigible. The airship made 43.2 miles an hour and easily exceeded the requirements of her specifications, which called for a speed of but 38 miles an hour.

An Accident to the Vaniman Airship.—Mr. Melvin Vaniman tried out his huge dirigible balloon, "Akron," on June 2nd, and met with a slight accident. A long rope which he dropped became entangled in the center propeller. This threw the airship off its balance, so that it careened. The ship dived down toward the water, but Vaniman succeeded in straightening her out again. After assistance from a motor boat, the airship rose once more. A few repairs were made in the air and the ship returned to its shed.

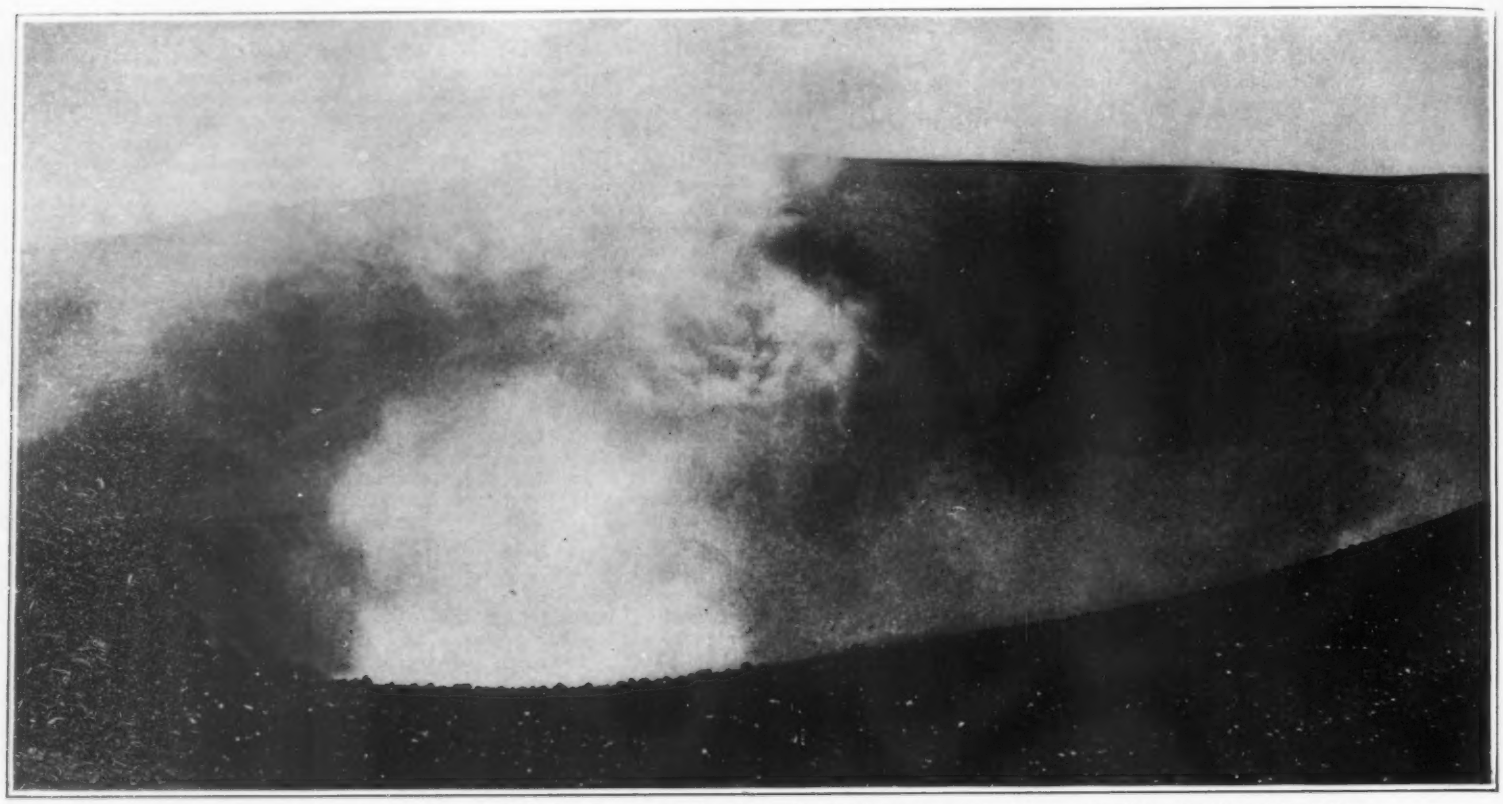
A Flight Across New York.—About 7 P. M. on the evening of May 31st, Oliver Sherwood passed over Harlem at a height of 1,500 to 2,000 feet while flying across country from Nassau Boulevard to Hackensack, N. J. He made this 30-mile flight successfully in 43 minutes, but two days later, while making an exhibition flight, met with an accident and demolished his machine. This is the second time Manhattan Island has been crossed at Harlem, Lekowicy in a Blériot monoplane being the first aviator to fly over the city, nearly a year ago.

Preservation of the First Wright Aeroplane.—A writer of a letter published in the London *Daily Mail* suggests that now is an opportune time for the British nation to obtain one of the original Wright biplanes at a comparatively moderate cost. He points out that at the South Kensington Museum may be found other interesting mechanical relics, such as George Stephenson's locomotive, the "Rocket." The suggestion is one that ought to be carried out in this country. Why does not the National Museum at Washington buy one of the early Wright machines, assuming that one is still to be had?

More Aerial Mail Tests.—The maker of the aeroplane which was exhibited at the Grand Central Palace Show as being the first mail machine, was unable to carry out the proposed flight to Washington, and Walter R. Brookins also was unable to make his mail-carrying test at Altoona, Pa., on the 24th ult. He has, however, agreed to make another test between Cliftondale and Lynn, Mass., a distance of four miles. Postmaster-General Hitchcock authorized the postmaster at the former place to dispatch mail for three days. After a few more experiments have been made in this way, it is possible that the Post Office Department will be able to start a regular aerial mail service.

A Record Flight in a Storm.—Paul Peck, a nineteen-year-old aviator of Washington, broke the American duration record at the Nassau Boulevard field on the evening of May 24th. Starting at 3:20 o'clock in the afternoon and carrying twenty-five gallons of gasoline and seven gallons of oil, he stayed in the air four hours, twenty-three minutes and one-quarter of a second. At about seven o'clock, when he was three thousand feet up, an altitude he maintained during most of his flight, a thunderstorm came up, and for a time the aviator was lost to view in the clouds. Now and then a flash of lightning would reveal him, circling in the air. He was so exhausted that he was hardly able to stand. Covered with oil from head to foot, he had to be assisted to the clubhouse by friends.

The Death of Parmalee.—On June 1st, Clifford O. Parmalee, one of the original Wright aviators, was killed at the Washington State Fair Grounds in the city of North Yakima, Washington, in the presence of his *finacée*. Parmalee was in the air only about four minutes when the accident occurred. His machine, which was identical with the one in which his partner Turpin fell upon the crowd in the grandstand two days before at Seattle, killing two spectators, was a two-propeller headless biplane, resembling the Wright, but with motor and propellers in front and aviator's seat at the rear. It was designed by Parmalee himself, who declared it to be the highest type of speed machine. A motor of nearly 100 horse-power drove two 6-foot tractors, the spread of the planes being 40 feet. Roy Knabenshue is authority for the statement that the machine was not properly balanced and that this fact, coupled with Parmalee's unfamiliarity with a tractor-and-motor-in-front aeroplane, was the reason for the accident.



The great crater of Vesuvius, which Prof. Malladra and a companion descended for the purpose of making a scientific exploration of its bottom.

Prof. Malladra's Descent Into the Crater of Vesuvius

Exploring the Interior of a Volcano Amid Choking Sulphur Fumes

Illustrated With Photographs by Prof. Alessandro Malladra

By Maurice Magnus

IMMEDIATELY after American newspapers had published brief statements to the effect that Prof. Malladra had actually descended the crater of Vesuvius and explored the bottom, the Editor cabled to his Italian representative and asked him to obtain a personal interview with the man who had performed an heroic task in the interest of science. It is much too early to publish a strictly scientific account of the results of the Professor's daring explorations. That must come later. In the meantime, we publish the following account by our Italian representative in which the difficulties of the descent are set forth.—EDITOR.]

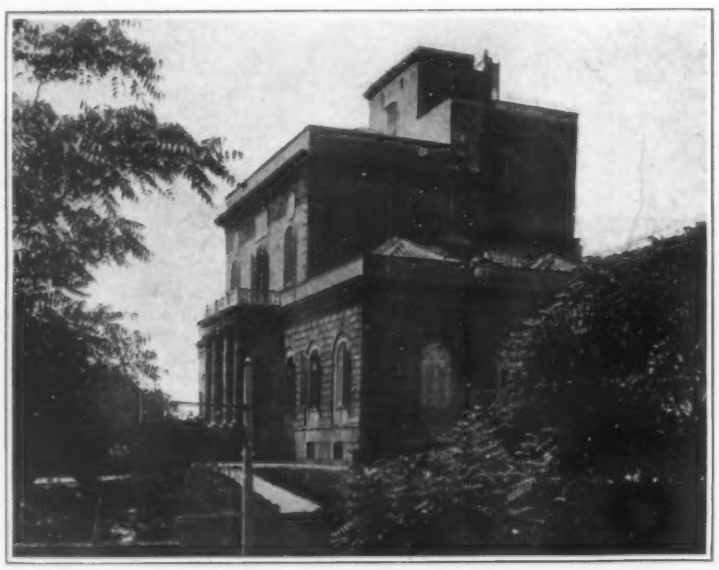
Prof. Alessandro Malladra, of the Royal Observatory of Vesuvius, succeeded on May 14th in descending into the crater of Vesuvius after many attempts. Prof. Malladra was accompanied by an old servant of the Observatory, Andrea Varvazzo. Starting from the brink facing Pompeii, and with their first rope of 450 feet length, they mastered walls formed like gigantic precipitous terraces alternating with steep inclines. A wide, sloping ledge of lava was reached, that plunged precipitously to a depth of more than 350 feet. The explorers turned on this ledge toward the south until they came to an incline with a 90 per cent downward gradient. With the aid of a 350-foot rope they slid down the incline and reached a huge mass that had tumbled down as the result of the upheaval of March 12th, 1911.

Prof. Malladra remained on the bottom for about two hours, studying every square foot almost and taking constant instrumental readings. Everywhere the thermometer registered the incredible temperature of 187 to 200 degrees. The depth of the crater is about 300 meters (984 feet).

From the south of the crater a small dark moving rectangle can be seen. There is an unbearable smell of sulphur. The *fumaroles* are numerous, some very close together, proof that smothered fire is present. At the bottom of the crater Prof. Malladra fixed a flag in the rocks.

The bottom of the crater is flat or at the most a little inclined, very irregular and filled with fallen masses. Prof. Malladra's descent to the bottom of the crater is not the first, for last September Dr. Corrado Cappello, with the help of the same guide, Varvazzo, succeeded in reaching the bottom. On October 16th Prof. Malladra was called from the Observatory of Domodossola by Prof. Marcalli to become a member of the staff of the Observatory of Vesuvius.

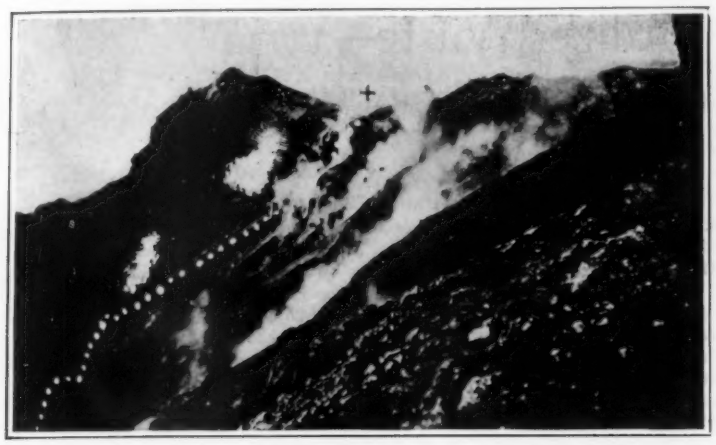
The Batteria Mercalli—a large group of fumaroles at the bottom of the crater. A thermometer dropped within any of them registers about 500 deg. Fahrenheit.



The Royal Observatory of Vesuvius where seismological and volcanic studies are made, year in and year out.

It was impossible to follow the path taken by Dr. Cappello, for on the 21st of January last a wall of the funnel-like crater tumbled in, leaving a huge cavity behind. It was necessary, therefore, for Prof. Malladra to find another path. He was bound to accomplish the descent so as to furnish the Observatory and the scientific world with more recent information than was available. Prof. Malladra also wanted to make this descent to study the entire eruptive period from the beginning to the last phase. Prof. Malladra and Varvazzo attempted their first descent about a month ago. They lowered themselves at the northwest side and descended for about 200 feet when, meeting a perpendicular wall of 120 feet, they were prevented from continuing. They tried again after five days, following the way taken by Prof. Corrado Cappello, but after having uncoiled a 150-foot rope they saw that owing to the crumbling which took place on the 21st of January, this path was also impossible. These two vain attempts did not discourage Prof. Malladra. Every day he went to the crater, studying its mouth and its walls, until he found a way which seemed practicable.

Finally he communicated to Varvazzo his intention of attempting a descent. After having gone about 150 feet they were obliged to return. The point chosen in this case at the south southeast side was also unfortunate. Prof. Malladra then tried another road more toward the east. This was on the same day. The two descended for about 200 feet. To their great delight they found that this was a good road. But it was already 3 o'clock in the afternoon—too late to continue the descent. They were obliged to



A cluster of fumaroles near the arch of the crater toward the south. The cross marks the spot where Prof. Malladra began his descent. The course which he took for the first 350 feet is indicated by white dots.

A battery of fumaroles toward the southwest. The picture was taken about 326 feet within the crater on the south wall. To the right appears the "devil who laughs"—a large face that appears in the rock amid fumes.

come up again, leaving their ropes in the crater, held by three wooden posts, so that they could continue the next morning.

That night Prof. Malladra told me he was so excited that he could not sleep. He had found a way to descend to the very bottom of the crater. He was so nervous that he could not calm himself.

The next morning the professor and the servant started with food to be consumed 950 feet beneath the mouth of the crater, 70 pounds of Manila and flax rope (950 feet in length), a barometer, a thermometer, and a camera. Prof. Malladra had also brought along several fusible wires of different metals to measure temperatures higher than those that could be recorded a temperature higher than that for which the thermometers were graduated. They were also provided with a magnetic needle (compass), a hatchet, a stick and plummets.

The first big wall was descended—a wall formed by the remains of the different eruptions—and this was followed by a descent over red lava from which several *fumaroles* opened. The temperature of these *fumaroles* registered 187 deg. Fahr. At this point a side wall descended for about 160 feet and presented the first obstacle. Wherever the two courageous men placed their feet, new *fumaroles* opened, from which sulphur vapors poured. When the descent of this wall was accomplished there was a second gigantic perpendicular one of lava followed by a *talos*, or cone covered by a bank of lava. There was a continual breaking and crumbling of ground difficult to escape from. Isolated masses fell with tremendous noise, bounding to the bottom, filling the air with dust and fine ashes. Prof. Malladra's hands were frequently cut. A big stone fell on the brim of his hat. Varvazzo was struck on the head but was so slightly injured that he could continue the descent. After a while the two explorers discovered another perfectly perpendicular wall completely bare, with no projections or crevices of any kind. After some moments of uncertainty Prof. Malladra was able to find a passage between two ridges of lava. At this moment he became aware that he had no more rope. One hundred and fifty feet had been left at the top, for he had not thought that it would be needed. Besides, he was left with more freedom of action.

There was still another 350-foot wall to be overcome, absolutely bare of any projection. No rope could be of assistance. The explorers, notwithstanding the stones, pebbles and land-slides, abandoned themselves to the slope, clinging to the smallest projections, till they reached the bottom of the crater, bruised and exhausted. Prof. Malladra and Varvazzo were nearly suffocated by the exhalations of sulphur. The two men crawled over the bottom of the crater, which measures in diameter 1,500 feet, bravely took photographs, made observations, collected salts and minerals, heroically bearing a frightful temperature.

At the bottom of the crater there are little hills and valleys, all irregular and not discernible from the top.

At about 2 P. M. Prof. Malladra and Varvazzo commenced the ascent, struggling with all their might. At 4 o'clock they reached the mouth of the crater.

A great slide on the west-southwest side which occurred on March 12th, 1911. To the right appears a group of fumaroles, emitting strong sulphurous vapors.

The famous "yellow" fumarole, so called on account of its strong yellow color. The fumarole is the cone in the center of the picture.

Fish Culture in Germany

THE industry of raising fish for the market is rapidly growing to large proportions, especially in Germany. There the tanks and ponds used for this culture number some fifty thousand, and cover an area of about 247,000 acres. The fish chiefly cultivated is the carp.

Tanks and ponds of different sizes are used, according to the age of the fish. The fresh spawn is placed in shallow basins, about twelve inches deep. The ponds and tanks are frequently emptied and cleaned, to remove animal parasites which might injure or kill the fish. After the fifth day, the young fry is placed in larger tanks for growing. The loss at this stage amounts to as much as from thirty to fifty per cent.

At the end of the first summer the small fish weigh from two-thirds of an ounce to two ounces. The fish are now placed in small ponds for the winter, and are again transferred in the spring to growing ponds for the second year. At this stage they are placed in the water at the rate of about 200 to the acre, and are kept here until they attain a weight of about one pound each. During the third year they are fattened up to three pounds on a special food prepared chiefly from the seed of the yellow lupine and corn, and they are thinned out to about sixty to the acre. The yield for the market varies from about twenty-five to one hundred and fifty pounds to the acre. The haul is made by means of nets, and by the draining of the ponds each winter.

Clay soils are found to be the most suitable as sites for the fish ponds. This agrees with the experience in other countries. When the ponds are made in sandy or granitic soil, the fish reproduce abundantly, but do not fatten up satisfactorily. When the ponds are emptied, advantage is taken of the exposure of the bottom to add lime and other fertilizers. The wintering tanks are emptied in the summer.

The carp and the tench, like most other fresh-water fish, become passive when the temperature goes below about 37 deg. Fahr. The loss sustained by the fish cultivators on account of the wintering is from one to ten per cent.

At three years of age the German carp weigh about three times as much as the French. The fish raised under artificial conditions present a nearly uniform size; this is an important factor in determining their market value.

The History of Lead-burning

IT is not generally known that the operation of soldering lead pipes with lead (the "lead-burning" of to-day) was known and practised in the middle ages. Reference to this matter is made in one of the books of Vincent de Beauvais (a reader of the court of Louis IX of France) who died in 1264. Following is the passage in question, taken from an essay on tin (vol. viii, part i): "If tin is exposed to a moist atmosphere, it will corrode; but human ingenuity has of late invented useful improvements by which it is possible to unite leaden subterranean water pipes with the aid of molten lead instead of soldering with tin. Pipes soldered with the latter metal never lasted long, but if lead is used it will last for all time."

How the Germans Utilize Waste—V

Wealth That Has Been Earned By the Efficient Use of Raw Material

By Waldemar Kaempffert

[*THE following is the fifth of a series of articles prepared by the Managing Editor of the* SCIENTIFIC AMERICAN *on European industrial conditions. The author was sent to Europe by the publishers of the* SCIENTIFIC AMERICAN *for the purpose of studying the application of science to business abroad. So much have the Germans done in the application of scientific principles to the utilization of waste, that little more can be done than to give glimpses of a small part of the vast field that they have so admirably covered.*]

If the Germans are thriftier and more systematic than we, the reason is to found not so much in any racial or temperamental difference between the two nations as in economic conditions. Germany's supply of raw material is exceedingly limited; labor is abundant and cheap. In the United States, raw material is still to be had in plenty; labor is comparatively scarce and expensive. What has been the result? Germany has developed to an amazing degree the utilization of raw material, but has still much to learn in the handling of great masses expeditiously by mechanical means. On the other hand, we in America have been recklessly extravagant in the use of our natural resources, but commendably ingenious in devising mechanism for handling what we do use. A change in American industrial methods is imminent. We have discovered that our coal and iron mines are not inexhaustible, that crops cannot be grown on the same soil year in and year out without rotation and without restoring the nutritive elements that have been removed; that our timber must be husbanded; and that what we call "factory waste" is not waste at all but so much raw material to be worked up in another form. We can learn much from Germany in the more efficient use of our wonderful natural resources; but we can learn stil more in the more effectual disposition of by-products.

The Transformation of Waste.

The most fantastic tale that ever appeared in the Arabian Nights is no more astonishing than the feats performed with waste material by the German engineer and industrial chemist. To the German a dump heap is a kind of gold mine. Better than any other man in the world, he has demonstrated the truth of Lord Palmerston's saying: "Dirt is merely matter in the wrong place."

It was the German, for example, who taught us how to use the by-products of the blast furnace. The smelting of iron ore was once accompanied with much waste. One of the most interesting examples of German industrial thrift is the briquetting of the enormous quantities of flue dust produced in the iron foundry. It has been estimated that the production of flue dust in the United States amounts to 3,000,000 or 3,500,000 tons annually. A large part of this is discarded as valueless. It is generally a fine material containing considerable coke and iron ore. The dust usually contains 20 per cent of coke and more than 40 per cent of iron. The coke is worth $3.25 per ton, and the iron ore 70 cents per ton. Hence, a ton of flue dust, unless made available, presents a considerable loss to the furnace man. The Germans realized this long ago. They have evolved several processes for pressing the flue dust into briquettes.

The Waste of the Foundry.

For every ton of pig iron produced per day, about twenty-five horse-power was once wasted by permitting the blast furnace to eject the gases into the atmosphere. Some 150,000 cubic feet of gas are generated in producing a ton of pig iron according to modern practice. About 35,000 cubic feet of that huge volume is carbon monoxide—a gas that burns with a blue flame in every household stove and that has great heating value. Time was when the carbon monoxide of a blast furnace was simply allowed to float into the atmosphere. Even at this late date we Americans do not husband it as we ought to. Here is a gas that contains so many heat units, so much energy in a word. Why waste it? Thus reason the Germans, whose fuel supply is none too generous. After years of investigation they found a way of collecting and cleaning the gas and of using it in engines of special design, thereby setting an example in the conservation of fuel to the entire world. At the Friedrich-Alfred Huette, one of the large Krupp plants, the gas from eight blast furnaces drives fifteen blowing-engines. That plant is not considered the most modern in Europe, but the story that it tells is told over and over again in every large German blast furnace installation. To our own credit be it said that the lesson has not been lost upon us. In 1902 the Lackawanna Steel Company installed the first American plant for the practical utilization of blast furnace gases. Since then, other American steel works have adopted the plan. At Gary we find the most remarkable example of the practical utilization of blast gases in the world.

How Waste Gas is Utilized.

Waste coke-oven gas is practically utilized on an amazing scale at Aalsdorf, near Aachen, Germany. Here will be found the largest plant in the world for the utilization of coke-oven gas. Following the practice of many European collieries, the directors of the Aalsdorf mines formerly burned the waste coke-oven gas under boilers to generate steam for a number of isolated steam-engine plants scattered over a wide area. That was certainly better than turning the gas into the atmosphere. But it was found that a large expense was incurred in maintaining many small steam plants. Besides, there was the cost of an extra engine in each plant, held in constant readiness in case a breakdown occurred. The condensation losses that occurred in long pipes leading from the boiler houses to the engines were difficult to contend with. Why not combine the plants into a single power station, generate current, and send it wherever required? That was the obvious remedy. One after another the steam engines were sold. A single gas engine plant was built. Current is now generated at a small cost and sent to any desired point.

Besides gas, the coke-oven yields tar and ammonia as by-products. Germany has built up a stupendous chemical industry on the utilization of tar. She needs tar as badly as she needs coal; for tar is the raw material out of which countless dyes, perfumes, explosives, photographic developers, drugs, extracts and narcotics are made. The tar left in the retorts of street-gas works soon proved insufficient to supply the demand. Tar had to be bought in England. That meant sending so much money across the Channel every year, money that might just as well be invested in Germany. Steps were taken to substitute retort coke-ovens for the old wasteful bee-hive type. By 1900 Germany produced 30 per cent of her coke in retorts; by 1910, 80 per cent. In a few more years all the coke will be produced in retorts, and Germany will increase her own supply of tar and ammonia. It may well be questioned whether the by-products of the German coke-oven are not now the main products. How stupendous is this industrial change may be gathered from the fact that before 1856 the gas maker was glad to rid himself of the coal tar by giving it away. He dared not pour it into streams because it polluted the water; and if he buried it, he was bound to kill vegetation. The advance that Germany has made over England in the substitution of retort coke-ovens for beehive coke-ovens is truly astonishing. Up to 1910, England was the greatest producer of ammonium sulphate. Now Germany has outdistanced her, simply because she systematically went about the business of supplying her own demand.

The lesson that the United States can learn from this admirable way of utilizing coke-oven by-products was driven home by Mr. John D. Pennock in a paper that he read before the American Chemists' Society. In 1893, he pointed out, the retort coke oven was introduced. From 1893 to 1910 inclusive, the coal coked in beehive ovens where the volatile nitrogen was ruthlessly wasted, amounted to 810,000,000 tons. Had this been coked in by-product ovens, Mr. Pennock assures us that the volatile nitrogen of the coal would have yielded twenty-three pounds of ammonium sulphate per ton, or a total of 9,315,000 tons, which at $60 per ton would have had a value of $558,900,000. But this would not be all. Had this ammonium been recovered, it would have been used to fertilize the soil, with the result that crops would have been increased fully 20 per cent and that a saving of many millions more would have been effected. While we stand far behind Europe in the utilization of coke-oven by-products, the situation is not as bad in this country as it once was. According to government statistics, a smaller number of beehive ovens is now made annually than in previous years.

The single item of nitrogen alone which is wasted in the coke oven is astonishing. Last year 63,000,000 tons of bituminous coal were converted into coke containing $22,000,000 worth of nitrogen, easily recoverable as ammonium sulphate in by-product ovens. As a matter of fact, we actually received but $3,800,000 worth and allowed more than $18,000,000 of this valuable material to go absolutely to waste. Worse even than this, over $20,000,000 worth of valuable gas and coal tar was wasted at the same time.

Benzol is one of the chief by-products obtained from coke ovens and gas works. It is of immense importance as a raw material to the German chemical industry. The owner of a German coke-oven plant recognizes how important is the recovery and rectification of benzol. From 25 cents to 35 cents can be extracted per ton of coke in the form of benzol. That is why the benzol plant is usually an adjunct of the German coke-oven.

The Ever-new Story of Coal Tar.

Nowhere in the whole world can there be found a more striking illustration of the wealth that lies in what was once regarded as a waste, than in the huge chemical works that have been built at Elberfeld, Leverkusen, Griesheim, Ludwigshafen and elsewhere in Germany, in all of which coal tar in some form is used as the raw material. So frequently has the story of coal tar been told, that it is now familiar in all its wonderful details to every well-read man. Yet the complete significance of the discovery of mauve by Perkin over sixty years ago is not really driven home until one has seen the enormous German chemical factories, in each of which thousands of men and women are employed in the task of extracting dyes, perfumes, flavors and drugs from derivatives of what was once a noisome ooze. From the coal tar which gas companies once disposed of with difficulty an industry capitalized at $750,000,000 has grown. In 1910, Germany made aniline and other dyes to the value of $29,250,200; alizarin worth $2,318,120; various alizarin dyes worth $2,641,800. And these are but a few of the thousands of products obtained from coal tar. The stock of the more important coal tar works listed on the Berlin Exchange pays from 10 to 32 per cent dividends annually—proof enough that money can be made out of waste if the scientist only points the way.

Hardly a week passes but patents are taken out for some new dye, some new explosive, some new drug or medicament, some new photographic developer that has been discovered in the laboratories of one of the great German chemical companies. One firm alone has taken out over 6,000 patents to protect its many discoveries in coal tar. It manufactures no less than 1,800 aniline, azo, and alizarin dyes, and one hundred and twenty pharmaceutical and photographic products. Naphthalene, one of the products of coal tar that was formerly a troublesome waste, choking gas pipes and otherwise making itself obnoxious, is now one of the most valuable substances for the preparation of dye stuffs. The manufacture of alizarin, an artificial preparation of the by-products of tar, has practically destroyed the madder industry of Europe. Synthetic indigo has completely supplanted the natural indigo of the Far East.

In all the large German chemical works, built to utilize the waste of the coke-oven and the gas retort, by-products are obtained, which, off hand, would seem to be of small use. It would be paradoxical indeed if an industry built up on the utilization of waste could not employ its own by-products. One of these waste materials is gas—oxygen and hydrogen in enormous quantities. A few years ago the German chemist (he now admits it blushingly) allowed these gases to drift into the atmosphere. The coming of the airship and the invention of the oxy-hydrogen flame has changed all that. At the vast plant of the Griesheim-Elektron Works near Frankfurt-on-the-Main, a more or less elaborate system of pipes and gas-holders has been installed to conduct and store the hydrogen in steel bottles, under a pressure of one hundred and fifty atmospheres. Hundreds of steel blocks are filled with the gas under high pressure, and shipped all over Germany. The demand for oxygen has increased so enormously since autogenous welding was introduced that a special plant has been installed at Griesheim to manufacture liquid air by the Claude process (described in the SCIENTIFIC AMERICAN some years ago), and from the liquid air, oxygen, as well as the other constituents of the atmosphere, is obtained by fractional distillations.

So large is the quantity of waste hydrogen generated at Griesheim that it has been found profitable to install a large balloon-filling plant at the works. Here the giant airships of Zeppelin and the smaller craft of Parseval may frequently be seen receiving their charges of buoyant gas, and here too as many as seven spherical balloons are inflated during a morning for one of those cross-country races which are more popular in Germany than in the United States. Even when they are not at Frankfurt the airships are often inflated with Griesheim waste hydrogen; for the gas is sent to them by rail in long steel flasks.

(To be concluded.)

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Photographic Phonograph

To the Editor of the SCIENTIFIC AMERICAN:

Your Paris correspondent in a recent issue of your paper entertained your readers with the narrative of a supposedly novel method of reproducing sound, consisting in forcing a current of air through an air-pervious sound record. If you will look at U. S. patent No. 908,683, you will see that this principle is my invention and dates back six years or more. I inclose a piece of a record such as I used at that time.

Philadelphia, Pa. E. LESCHBRANDT.

The Pontoon Life-saving Method

To the Editor of the SCIENTIFIC AMERICAN:

Your leading article and illustration in your issue of May 11th on the pontoon method of life-saving at sea reads well, but the trouble with most such ideas is, accidents are not well regulated. They seldom occur in such a manner as to allow for the successful accomplishment of such theoretical preventives.

The testimony showed that the "Titanic" went down head first in a nearly perpendicular position; and a pontoon as described, in the case of the "Titanic," would have undoubtedly resulted in the loss of even more lives than occurred.

To successfully launch the pontoon, the vessel would have to sink on an even keel.

New York city. FRANK P. DAVIS.

[The pontoon, as illustrated, would be built with water-tight steel doors, opening from the top deck and water-tight steel cover-plates for the port holes. Even in the case of a ship's going down perpendicularly, as the "Titanic" is reported to have done, the pontoon shown would have floated on an even keel after it was separated (by its buoyancy of several thousand tons) from the main structure of the ship. The idea looks, to a conservative mind, fantastical; but it is perfectly practical—or would be, as worked out by the naval architect.—EDITOR.]

A Transcontinental Highway

To the Editor of the SCIENTIFIC AMERICAN:

Just in proportion as the automobile increases in favor, so roads become more a national than a local issue. When horseback riding was the principal means of getting about, trails were sufficient. As carriages came into use, better roads were required, and the counties, and in some cases the State, undertook their construction. As the automobile lengthened the radius of communication, the State was no longer the limit, and the question became one of national affair.

It is this very situation which demands national roads. The original opening of the West required the transcontinental railroad, which was followed by branches. This process in highway building will advance the development of Colorado, Nevada, Wyoming, Idaho, Arizona, and other middle West States more than any other. That is, first should come the national transcontinental highway, to be followed by local branches.

It is not possible for these sparsely settled States to build the necessary roads. If this vast territory is to add its share to the national wealth, it will be because national assistance in road building is given. The government is spending great sums on irrigation projects, which will make immense areas productive, but nothing at all in making markets available.

The building of great national highways would wonderfully stimulate the populating of this territory. It would entice the easterner into spending his vacation touring this wide area, where he would not only find scenery beyond imagination, but he would thus become acquainted with the possibilities of this inter-populous section, and its many products, which it will take men of the right kind rather than mere money to develop.

It is not generally known that cotton is grown in this section; or that there is a larger deposit of asphalt here than in the whole island of Trinidad; or that dry farming is producing twenty-five bushels of wheat to the acre, and with irrigation undreamed crops of many kinds.

At a banquet given the writer and friends by the Chamber of Commerce of Salt Lake City, the governor of the State and mayor of the city also attending, samples of this dry farming wheat with roots twelve feet long were exhibited. The wheat roots apparently hunted water, and as roots ten feet long are not uncommon, it would seem that moisure in considerable quantity is to be found at about this depth.

Irrigation where available, and dry farming where water is not available, is gradually changing these arid, trackless wastes into wheat fields and gardens. This would go on at a rapidly accelerating pace were the territory better known and more accessible.

The building of such roads as are necessary is by no means a difficult feat; for while in the East and middle States road surfaces as well as bridges are needed, in the middle West bridges and culverts and particularly sign posts are the principal requirements.

During a transcontinental automobile vacation tour last summer, we were struck with the unexpected fact that the farther west we got, the better the roads became. The average of roads in the West is better than the average of roads in the East. Probably this comes about by the very nature of the soil, for in the West there are vast stretches of territory on which little vegetation at present grows, and the ground is hard and smooth, while in the East the loamy soil is too soft for good natural roads.

It is just such tours of investigation as this that the writer suggests to the easterner, and what he will see and learn on his trip will be a series of surprises and a wealth of information to him.

But don't tour alone. There should be three or four automobiles together; for mutual protection against mechanical troubles. A broken side-frame in the Allegheny Mountains, and a broken crank-shaft on the plains, during our trip, were rendered innocuous, and without inconvenience even to the ladies of the party, by reason of the attendance of the other cars.

Washington, D. C. C. FRANCIS JENKINS

A Criticism of the Oldfield Patent Bill

To the Editor of the SCIENTIFIC AMERICAN:

As a pioneer inventor in the line of key-operated adding and calculating machines, I address you in protest against the provisions of House bill No. 23,417.

With the compulsory license clause of Section 17, House bill No. 23,417, enforcing the granting of a license in case of insufficient working after the expiration of four years, a poor inventor would be helpless and completely at the mercy of the established manufacturers in his line; and the clause in the same section of this bill to compel the granting of a license to one who claims to have made a substantial improvement on an existing patent would, in effect, render nearly all patents worthless. With less security in a patent than that afforded by the present laws, there are few important inventions which anyone could afford to pioneer.

The introduction of a truly pioneer invention is usually a tremendously expensive proposition, involving hundreds of thousands of dollars of expense, and often years of discouraging labor in the face of large annual deficits. No one could afford to incur such risk if, after educating the public to a point where the business became profitable, a competitor could come in with an alleged improvement on the same and claim the right to step in and reap the fruits of the labors and investment of him who has given the world a new process, device, or machine, educated the public to a realization of its value, usually in the face of almost unsurmountable inertia and prejudice.

How could a firm which was burdened with great initial expense, on which of course they must earn current interest, to say nothing of interest on the investment during years of unprofitable business or the hazard of never winning out at all, compete with a firm unembarrassed by great initial expense, who merely comes in to reap the harvest sown and cultivated by the pioneer?

Patents on inventions are often regarded as gifts or prizes given to encourage invention. In truth, they should be regarded as what they really are, merely a title to and protection of, for a limited time, property created by the patentee. Morally, it is his by right just as much as is a piece of real estate made valuable by his labors; the fact that, technically, the patent on an invention is called "patent" or "license" and the patent on the land a "deed" in no wise changes the moral situation. Because in the past the inventor has not received his full due and protection in the fruits of his labors, and that the one is technically called a "license" and the other a "deed" should in no wise prejudice a fair consideration of the moral rights of the one as compared to the moral rights of the other. Under our present patent laws the inventor cannot patent anything of which he is not the original producer, and it can by no means be fairly said that he is depriving the public of something which previously did not exist and possibly never would have existed were it not for his labors. After a comparatively short time the public receives practically all the benefit from the invention. As it is, he gets little enough, and to abridge the rights he now enjoys would be a grave mistake.

At the present time an invention is seldom, if ever, the result of a "happy thought" or inspiration. Practically all the chance-for "happy thought" inventions, if there really ever was such a thing. has been exhausted. To-day an invention of any material benefit to the world is almost invariably the result of long and laborious study and experimentation. I am afraid that the public at large does not fully realize this fact. It is unfortunate that as a rule the man who possesses the capacity and inclination to produce valuable inventions very rarely has at his command the necessary means to bear the expense of perfecting his invention, to say nothing of the large expense involved in the manufacture and introduction of it.

Nearly everyone knows of some old man who has puttered away his life at futile and unintelligent experimentation, but who never could develop a really meritorious invention if he lived a thousand years; it is this type which most people have in mind when we use the term "inventor." He would probably putter away anyhow, even though there were no patent laws; but the true inventor would devote his energies in some other direction, from which the general public might derive any particular benefit. The true inventor has in mind hundreds of new things which, had he time, he could develop, but he wisely sticks to one or two, and develops them to a point where they are of utility to mankind. In the development of the one thing, usually he must necessarily conceive and perfect dozens, and sometimes hundreds of details and solve many problems, the developing of any one of which requires more mental effort and "inspiration," if there be such a thing, than the original conception.

Under the workings of the present patent laws some wrongs may be committed, but they are very few indeed as compared to the benefit derived by the public from these laws or the wrongs which would be committed under the proposed new law. To change them without a true understanding of the relation of the inventor to the public would surely result in great injury to the public. As they stand, they have been a great benefit to this country, and it would be a great mistake to try to change them by passing the compulsory working feature. In the recent English law, which was undoubtedly passed solely to stop the sale in England of the manufactures of other countries, the law was admitted by most of the writers and speakers on the subject in England to be outrageously unfair to the inventor, but was excused on the grounds of favoring home industries as against foreign industries. The world owes inventors more than it can ever repay. Because of their labors in the last hundred years common people now enjoy what would have seemed luxuries to kings a hundred years ago. But it also requires capital, usually large capital, to introduce revolutionary inventions. Manufacturing that kind of inventions is very risky business. In my line, for every firm that has succeeded, a dozen have failed after the investment of from ten thousand to a million dollars each. In considering a matter of this kind, the public only looks at the profits of the successful and forgets the original hazard, and that doubtless in any radically new line of industry more money is lost by those who fail than is made by those who succeed. If this law is passed, the inventor who brings out something radically new will find it practically impossible to procure capital. The prospective investor would regard it as merely buying an opportunity for endless litigation. The situation is bad enough in that respect under the old law.

All the talk about established manufacturers buying up inventions to suppress them is based on less than one per cent of fact. There are thousands of men who every time they see something distinctly new immediately think that there is something susceptible of improvement, and start out to invent improvement. When they get through they invariably think they have made a great improvement. Nine times out of ten it is something that has been tried and discarded by the manufacturer of the original article, and in every single case the device as presented to the manufacturer would take months of experimentation and refinement, requiring the exercise of a great deal more inventive faculty than exercised by the one who thinks he was the first to think of it, expended in producing what he conceived of as being an invention.

Some manufacturers make a practice of buying patents on devices in their line, thinking that at some time they might have use for them. Usually the device is of no practical value, but in every case the inventor imagines that it is of great value, and thus that the manufacturer is merely buying it to bury it. The inventor or firm which brings an invention to a point of actual utility and introduces it to the public is morally the one entitled to all the protection under the patents on the same. If there is to be any change in the patent laws, there should be a change in this direction. Every inventor of a truly new and valuable device finds his patents more or less clouded by prior patents on devices of no practical utility whatever, patented by men who had they a million of capital behind them could never have brought their conceptions to a point where they would have been of any utility to the general public. As a matter of fact, they merely wished for something, tried to produce it, and finally applied for a patent, which when issued lay dormant, where it was of no possible value to the world. then some day it is resurrected to cloud the title of some patent in the same line made by a man who actually did produce something useful. It is a mistake to suppose that the public eagerly takes advantage of modern inventions. In almost every case the public must be educated to it.

Chicago, Ill. D. E. FELT.

Carting cotton to the gin.

A battery of moving picture cameras at work.

Industrial Uses of the Moving Picture

How and Why Moving Pictures Educate and Advertise

By Watterson R. Rothacker

IT is said by experts who have made a careful study of the situation, that in the United States alone there are approximately 30,000 places at which moving pictures are being more or less continually shown. The list of licenses issued by city clerks throughout this country shows that of this number about 12,000 places are moving picture theaters devoted exclusively to the business of entertaining the public; the remainder being schools, opera houses, chapels, churches, halls, etc. Statisticians have calculated that 5,000,000 people visit the moving picture theaters of the United States daily, and it is estimated that in one year over two hundred million admissions are made to places where the attraction is moving pictures.

It was only a few years ago that moving pictures were generally introduced to the American public; their popularity was instantaneous. Several years after the innovation they were so high in popular fancy as to coin the phrase "moving picture craze." Now they have outgrown the "craze" stage; they are no longer considered a fad; they are recognized as an established institution.

As moving pictures have enlarged and made permanent their following, so has been enlarged their scope, until to-day instead of being used merely for amusement purposes they have an accepted value as advertising and educational factors.

Many of the most reputable business houses in America, more than a few of our most important railroads, and some of the most enterprising civic organizations, are using moving pictures to advertise and standardize a name, enliven a trade mark, explain a manufacturing process, demonstrate machinery, exploit a territory and recreation resorts, attract attention to a city or place. They are pictorially proving their proposition by actually disclosing it as it is and moves.

For instance: A corporation internationally known as a manufacturer of high explosives, by means of moving pictures proved to the farmers of Missouri, and all the other "Show me!" states, that dynamite can be effectively and economically used to clear land of trees, stumps and boulders—plow the sub-soil by easily breaking up the hard-pan—make tree planting easy—and do ditching at a minimum of labor and expense. This series of moving pictures was entitled "Farming With Dynamite." They were exhibited by agents of the powder company at Farmers' Institutes, Agricultural and Mechanical Colleges, Land Shows and other places where were assembled people who were considered logical "prospects" and possible buyers of the product advertised. So many copies of the film were circulated among the moving picture theaters in rural communities, and this campaign was so well conducted, that the real value of high explosives to the farmer has, by this method, been revealed to millions of people who have, each one, been impressed with the name of the company thus advertising.

One of the greatest manufacturers of tractor engines in the world conceived the idea of demonstrating their machines by making one perfect demonstration a matter of moving picture record and then manifolding the power of the demonstration by having copies struck off on films and circulated broadcast. The original demonstration was filmed under most favorable conditions and then by mechanical multiplication so reproduced that this demonstration is now in many parts of the world being shown to prospective customers with the same realism and effect as the original test itself.

Another manufacturer of agricultural machinery has adopted a similar course and by means of moving pictures is demonstrating heavy harvesting machinery in South America, Russia, Europe and other foreign places where it would be impossible to handily show an actual

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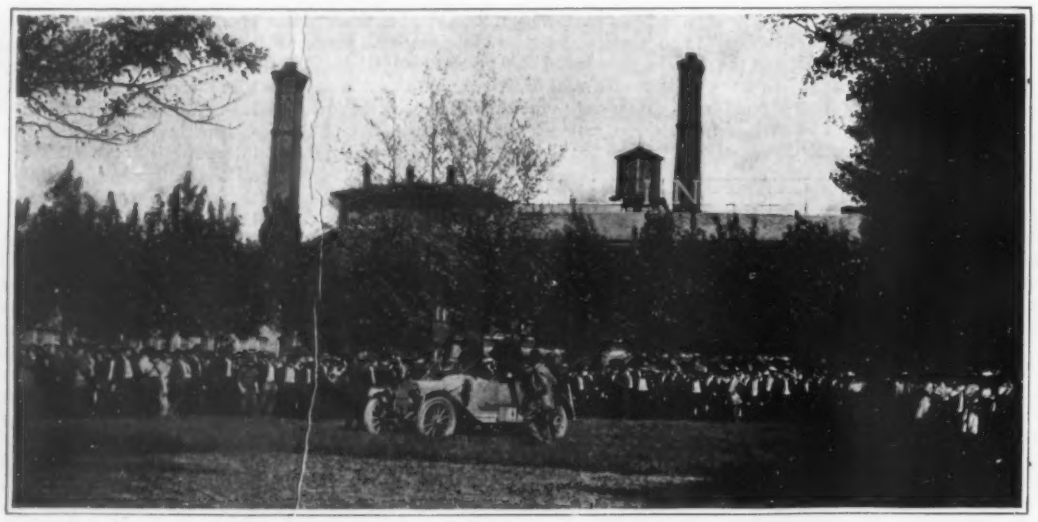

Taking moving pictures of a large manufacturing company's employees. The camera and the operator are in the automobile.

Plowing with dynamite.

How We Can Utilize $250,000,000 Worth of Wasted Timber

The Beginning of a New American Industry

Deadening produced by girdling in Mitchell County, North Carolina.

Forest Office men sealing dead lodgepole pine in Colorado.

ONE of the most important and urgent problems for conservationists to solve is that of making the fullest possible use of the dead and down timber in the United States. To utilize this material before it deteriorates would in the aggregate represent a surprisingly high money value. Success in this, however, can not be measured directly by the revenue derived from it, because the value of the wood itself is small as compared to the saving in other ways. The use of dead timber results primarily in a threefold economy—the prevention of waste, a saving of the more valuable standing timber for better uses, and lessening the danger from fires and insect pests. Dead timber in the forest or cut-over land naturally increases fire danger. Insects which work in living timber may breed in the dead and down timber, or especially in that which is damaged on the borders of burned areas, where they multiply and after a few years threaten bodies of living timber.

There are four classes of dead timber: (1) Fire-killed timber, (2) timber killed by insects and parasitic fungi, (3) over-matured timber, (4) timber killed by other causes, such as wind, lightning, excessive drought, land slides, etc. These causes are all more or less beyond the control of man. There are also vast quantities of useful timber destroyed annually through crude and wasteful methods of lumbering and milling; but next to waste in lumbering, fire-killed timber represents by far the largest part of the dead wood in this country, and it is found in every forested region. Insect-killed timber is usually scattered or restricted to such small areas that it is not so generally observed. Timber which naturally matures and dies is confined chiefly to one or two trees to the acre in an uneven-aged forest and often seems inconsiderable when it is compared with the fire-killed timber which occurs over extensive areas, but the aggregate amount of it is very large. The amount of dead wood which results from damage done by wind, lightning, etc., is very great, and the material is usually so scattered that all efforts to estimate the amount or to utilize it are precluded.

It is impossible to secure even approximate figures on the amount of dead and down timber left in the forest from any cause. Fair average estimates can be made, however, which will serve for all practical purposes. At present only 33 per cent of the cubic contents of the tree reaches the consumer in the form of lumber. The total production of sawed timber during 1911 amounted to 50,000,000,000 board feet. It is easy, therefore, to calculate that about 92,000,000,000 feet must have been left in the forest in the form of lops, tops and stumps, and wasted at the mill in the form of slabs and sawdust. A canvass as to the amount of timber that is killed annually by insects has never been made except perhaps in the Black Hills where there are many millions of board feet of such timber. It is safe to place the estimate for the whole country at 500,000,000 feet. The average age of a tree may be said to be 100 years, and it is fair to suppose that under normal conditions 1 per cent of all the trees die every year, which affords a basis for calculating the loss through this cause. The present stand of timber in the United States is estimated to be 2,500,000,000,000 board feet, and 1 per cent of this is 2,500,000,000 board feet. About nine-tenths of the rural and farming classes in the wooded States use wood for fuel. They use the best of it, taking the bodies of thrifty trees and the largest limbs only, except where younger growth is more convenient. It is safe to assert that fully 500,000,000 board feet are left in the forest through this wasteful practice. All other causes, such as fire, wind, insects, lightning, and direct results of the use of injurious methods of turpentining in the Southern pine belt, swell the amount of waste material enormously. The entire loss from these sources may be placed at 4,500,000,000 board feet, which makes the total amount of dead and down timber in the forest and the waste as a result of conversion into lumber about 100,000,000,000 board feet annually.

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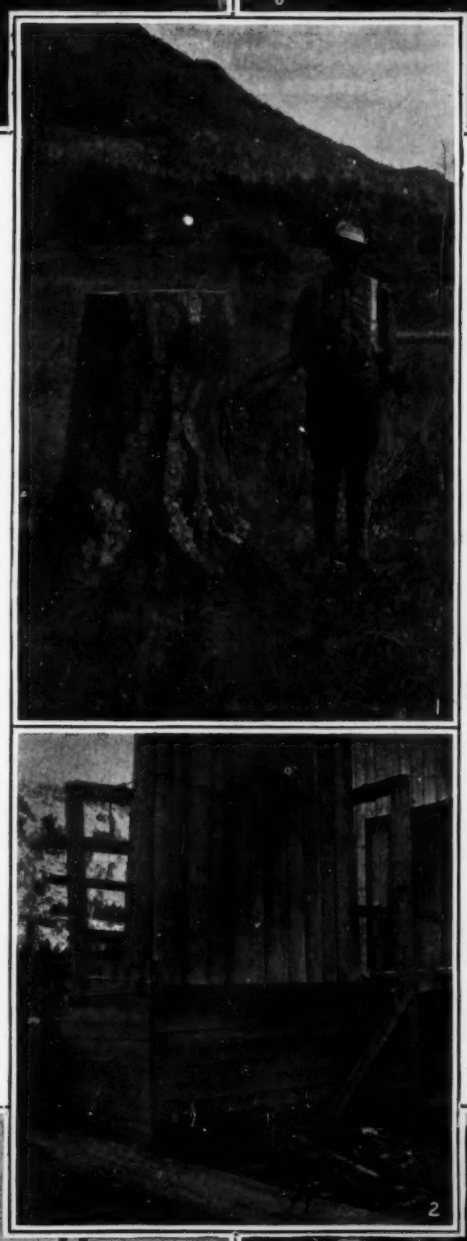
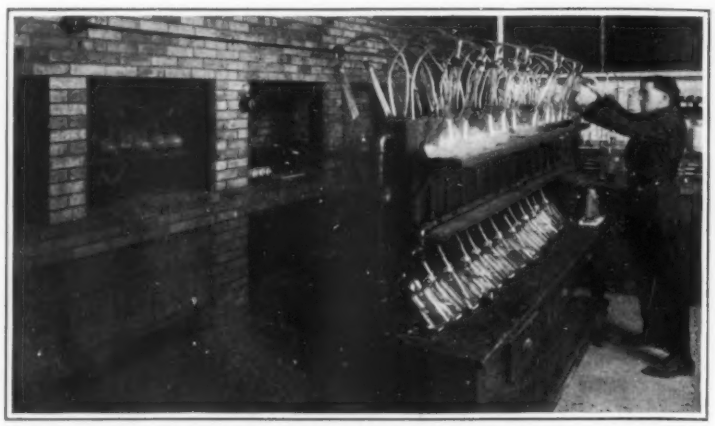


1. The great waste of good lumber in high stumps. 2. An open tank used in treating fire-killed lodgepole pine. 3. Ovens used in extracting turpentine from dead wood. 4. Lightwood used for making turpentine, tar and charcoal.

The kettle room, where soap is made. The ingredients are mixed together in steam-coil-lined kettles, three and four stories deep.



The fertilizer department of a packing house chemical laboratory, showing the apparatus for nitrogen determination.

An Industry That Thrives on the Utilization of Waste

What the By-products of the Packing House Mean to This Country

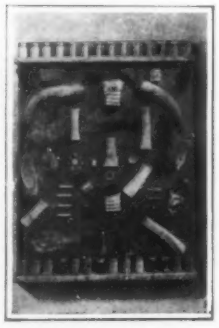
By E. Scherubel

[*NO doubt the most conspicuous example of the industrial utilization of waste, one, moreover, of which Americans have reason to be proud, is to be found in the meat-slaughtering centers of this country. The beef and pork that hang in every butcher shop represent not more than fifty-six to fifty-eight per cent of the animal on the hoof. Time was when the remaining forty-four to forty-two per cent was simply thrown away. Now, it is safe to say that nothing escapes the boiling kettle or the machine, and that a steer is utilized from the tip of his horn to the last hair of his tail. In the following article, written by a chemist in the employ of one of the largest packing houses of this country, it is shown that the American packing industries' profit is made, not from the sale of meat, but from the chemically and mechanically treated by-products of the abattoir.*—EDITOR.]

Perhaps in no other American industry has the utilization of by-products been developed to so great an extent or become of such vast importance as in the modern packing house. In times past, before the big packer came into the field, such things as by-products were little utilized, nor were the possibilities in this direction fully realized; but the complex civilization of the present day, together with keen competition and the expenses of distribution, maintenance and the enormous capital involved have made it necessary, for the existence of the industry, that the field of usefulness for former waste materials be largely extended and this in turn has made possible greater development. The success of the large packer of to-day is in his ability to sell the meat from a steer for a less amount of money than the steer cost alive. In order to do this, all of the many expenses of killing, refrigeration, shipping and a hundred other items must be met with the proceeds from the sale of the by-products and a profit realized on the investment in the business. During 1911 the profit of one of the largest packers was less than three cents on each dollar of sales. The great industrial progress of the present time has come and has been made possible by the coincident development of science which has placed the foundation for all industries on a rational basis. This interdependence of science and industry is nowhere better exemplified than in the development of the numerous by-products from the packing houses, so that in truth, we have here one of the best examples of conservation; and the old saying that "there is nothing lost but the squeal" expresses the facts thoroughly, if not elegantly.

We may possibly gain a more compre-

In the bulbs on the left experiments are being made in the sulphuric acid digestion of fertilizers. The chemist is analyzing fertilizer for potash.



The picture on the left shows the loose wool storage room of a Chicago packing house. The picture on the right is a collection of packing house by-products.

Milling is necessary to give toilet soap a smooth and even texture. The mill consists of two series of granite rollers through which the chips pass in succession, leaving the machine in ribbon form.

hensive idea of the magnitude and importance of the by-products obtained from animals when our attention is called to the fact that practically all of the profits of this industry are now derived from their successful exploitation. In fact, the growth along this line has been so great that we may almost regard them as being on a par with the main products; for they have in reality become a great asset and contribute enormously to the business. For the purposes of this article we shall consider as by-products, in a broad sense, all parts of the animal except the dressed meats. It is readily seen when one takes into account what an animal loses in the way of hide or skin, blood, internal organs, etc., during the process of conversion into dressed meat, that here is an abundance of material which requires utilization. When it is considered that the capacity of some of the larger packing plants is 3,000 cattle, 10,000 hogs, and about the same number of sheep daily, one can see what an enormous waste this would amount to in a year and what an influence this would have on the prices of fresh meat were the packers not able to convert it into a profitable form. In order to show the high degree of specialization which the by-product industry has attained, it is only necessary to mention the large number of products that are obtainable and have a market value. It is not a matter of great difficulty to enumerate a list of 175 different articles derived from a steer which can be legitimately classed as by-products. The bones alone will furnish thirty articles; and the above number does not exhaust the possibilities.

Let us now review briefly the two large and general classes of by-products, namely, the edible and inedible, and note in what manner they are made use of. Under the first general heading of edible products are classed the various fats and internal organs. The cattle furnish the packer with his edible tallow, oleo oil, and oleo stearine. The edible tallow is obtained from what is known as "cutting bones," i. e., pelvic, rib and blade bones, and also from the marrow, and is used to some extent in the manufacfacture of high grade white soaps. Of more importance than this fat, however, is the oleo oil and stearine which is obtained from "oleo stock" which is rendered from the ruffle and caul fat. This stock is carefully washed, hashed and then rendered in kettles from which it is drawn off into trucks and allowed to crystallize, when it is put into small cloths and pressed in a power press. The oil thus obtained is one of the highest grades of edible oil and is extensively

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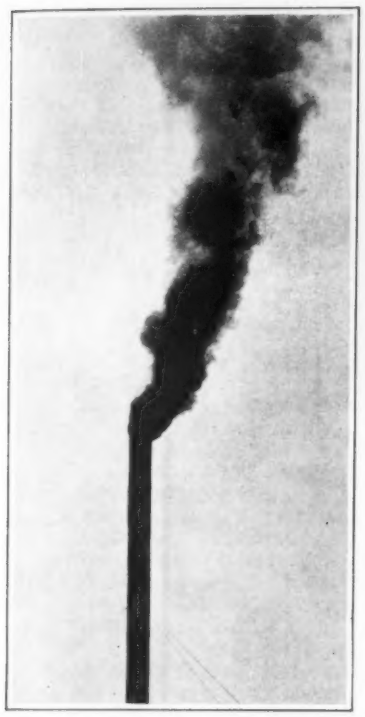


Fig. 1.—The fuel was not evenly spread. Hence the smoke.

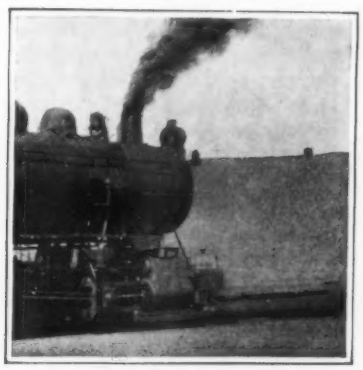


Fig. 4.—Fresh coal has been shoveled into the fire box.

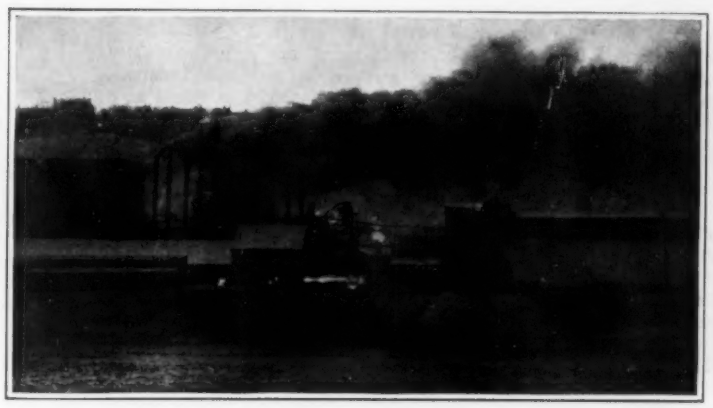


Fig. 3.—A typical hand-fired boiler plant operating under smoke-producing conditions with heavy spreadings of slack coal.

The Dividends That Float Up the Chimney

What Smoke Means in Dollars and Cents

By S. B. Flagg, Engineer, United States Bureau of Mines

[A smoking factory chimney has ever been a symbol of industry. To the modern engineer it is almost a badge of shame; for it means inefficiency in fuel consumption, half-burnt coal, and dividends that should be distributed among stockholders but are allowed to drift off into the atmosphere. A few years hence the owner of a smoking factory chimney will be classed with the spendthrift who lights cigars with ten-dollar bills. Extravagance in the burning of fuel is a matter of national concern, inasmuch as our coal supplies are fast dwindling. It is for that reason that the Bureau of Mines is making a painstaking study of the conditions under which coal is consumed in the fire-box. Mr. S. B. Flagg, the author of the following article, is one of the engineers who is employed by the United States Government to study this important problem. His article is a scientific sermon in which he preaches the doctrine of fuel economy.—EDITOR.]

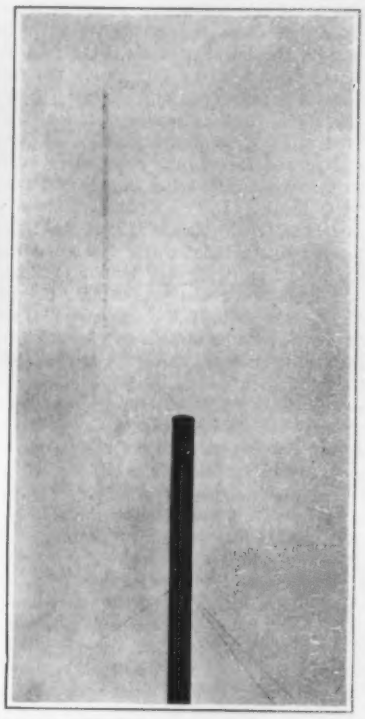


Fig. 2.—The fuel was spread uniformly over the whole grate.

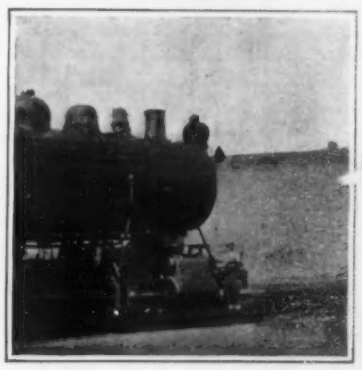


Fig. 5.—Absence of smoke, due to the stack-blower and combustion-tubes.

DURING a period of exceptional prosperity and development such as this country has enjoyed throughout the greater portion of the last thirty years, attention has, as a rule, turned to expansion of business and increase of ouput. It is usually not until conditions arise that check such a growth that serious consideration is given to economy of production. It has been true particularly in the United States during these prosperous years that power plants have been overloaded or quickly built to take care of the extra demands for power, and comparatively little attention has been given to economy of power generation or to smoke prevention. In fact, the production of smoke had in the minds of most people become so associated with the generation of power that a general smoky condition was considered as an evidence of prosperity, and a certain amount of pride was taken in maintaining such a condition.

In the last few years, however, power plant owners and operators have been awakening to the possibilities of increased economies in power generation, and with this awakening has come a growing realization that a smoky stack, instead of being a sign to which to point with pride, is rather an indication of faulty furnace design or of improper operation. It does not necessarily follow because a stack is emitting smoke that the plant is being operated with heavy losses; there are some plants producing power at comparatively low unit costs that are making smoke, but these are exceptional. In most instances, a smoky stack indicates inefficient operation, but the loss results not so much from the failure to realize the heat represented by the solid particles of combustible matter in the smoke as from the escape unburned of certain gases that usually accompany the smoke and may, under some conditions, represent 20 per cent of the calorific value of the fuel used. The plant owner or operator, however, is not the only one to suffer losses from smoke emission. The increased expenses for laundering, cleaning, and illumination, as well as the destruction or depreciation of merchandise, may all be considered as smoke losses. A professor in Leeds University has stated that the smoke cloud cuts off 40 per cent of the sunlight in that city. This decrease of light and sunshine, according to recent investigations, is one of the factors contributing toward the destruction of many varieties of plant life. In some cities, owing to this cause and to the deposit of soot upon the leaves, it is impossible to grow certain trees and plants and others are grown with difficulty.

The statement is made that in the metropolitan area of London there are 76,000 tons of soot deposited annually, and that in Chicago over 200,000 tons of soot and cinders are thrown out of locomotive stacks and spread over territory adjacent to the railroads in the same length of time.

During the last ten years, many investigators have been working on the problem of preventing smoke and saving fuel. Many of the educational institutions have published results of experimental investigations, various societies and associations have had committees studying different phases of the subject, and during the last eight years the Federal Government has done a great deal of work along these lines. These investigations, originally conducted by the technologic branch of the United States Geological Survey, have been continued during the last two years by the United States Bureau of Mines. The manufacturers of mechanical stoking equipment and the builders of some of the special furnaces have also contributed largely toward the improvement of conditions.

The result of all these efforts is fourfold and is manifested in the following ways: (1) improved design of furnaces and mechanical equipment, (2) a growing realization that the proper firing of fuel requires intelligent supervision, and that conditions in the fire-rooms should be such as to attract and keep such a class of stokers, (3) an increasing public sentiment in favor of smoke abatement and smoke prevention, and (4) organized efforts to bring about the enactment and enforcement of statutes to control the emission of smoke.

The combustion process, as is generally known, consists of the chemical combination of the combustible elements of the fuel with the oxygen in the air, and for each substance there is a temperature, called the ignition temperature, below which it will not burn. Briefly stated, the requirements for efficient and smokeless combustion are that the proper amount of air shall be supplied and that it shall be mixed with the gasified coal, oil, or wood before the temperature of the mix-

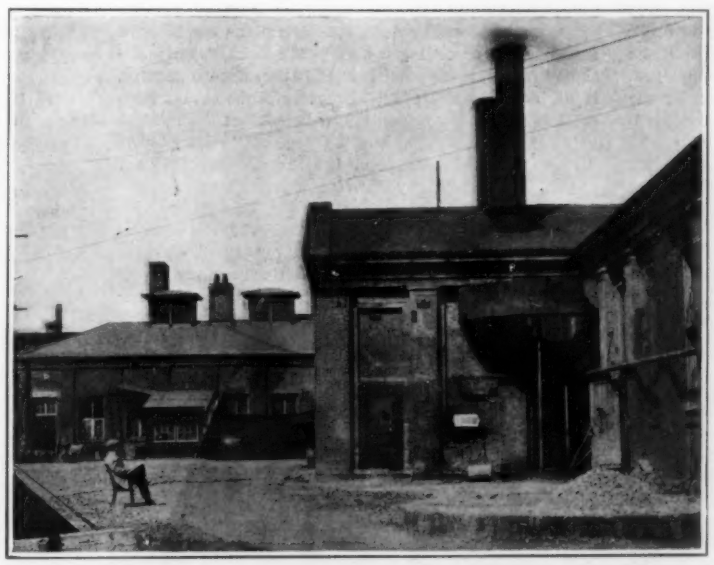
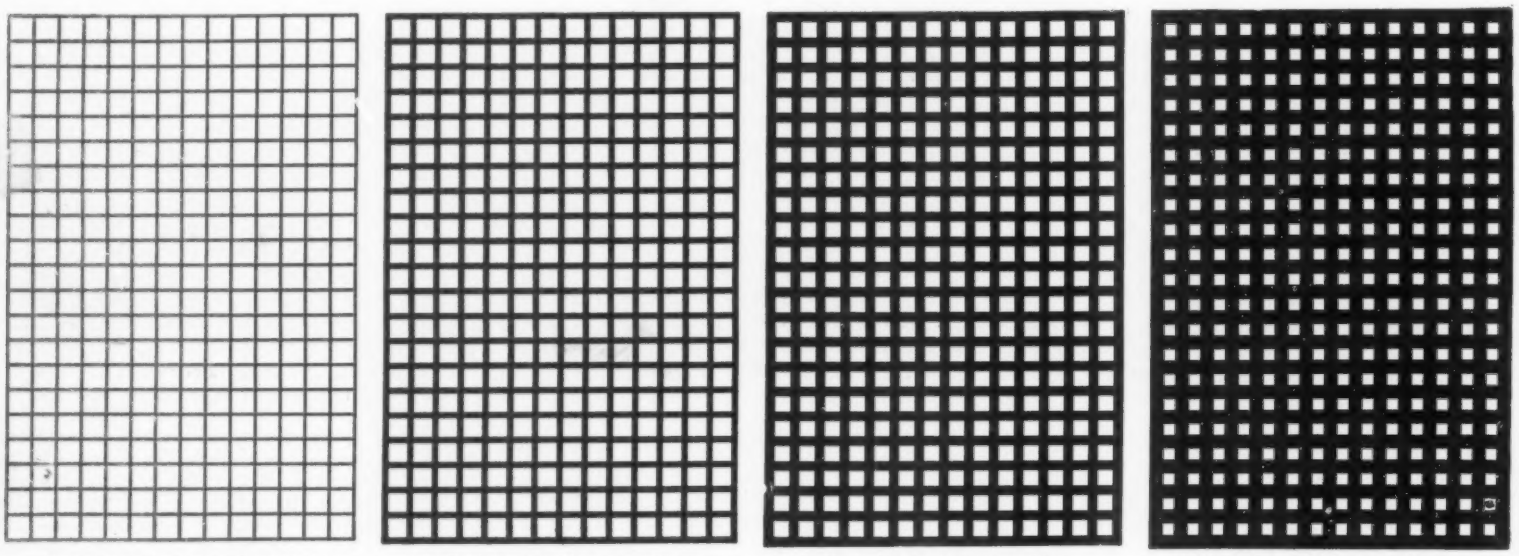


Fig. 6.—The man in the chair is studying the smoke rising from the chimneys with the aid of the Ringelmann smoke-chart, reproduced on the next page.

ture is brought below that at which it will ignite. In order that these requirements may be best complied with in the burning of coal, the fuel should be mechanically fed, as by this means the feeding may be more uniformly done and the air supply more easily regulated. If bituminous or soft coal is to be fired by hand it is, of course, impossible to have continuous feeding and therefore the air supply must be varied, an extra quantity being necessary immediately after firing because of the rapid distillation of the gassy part of the coal. The mixing of this extra air and the volatile combustible matter is accomplished either by the use of steam jets or by the employment of brick arches, piers or walls to deflect the gases in their travel. The method of firing may also affect both the quantity of smoke emitted and the efficiency with which the fuel is burned. The effect of the method of operating a furnace upon the smoke emission is strikingly shown in the two photographs, Figs. 1 and 2, each of which was taken 25 seconds after the fire had been coaled and the firing doors closed. In each instance approximately 75 pounds of coal (a mixture of nut and travel. The method of firing may also affect both the smoke emitted is explained by the fact that one of these chargings of fuel was spread uniformly over the whole grate and no extra air was admitted immediately after firing; the other was put on the forward portion of the grate where the gassy part of the coal was driven off more slowly, and extra air was admitted over the fire. At the same time that the extra air was admitted two steam jets at the front end of the furnace were put into operation for the purpose of mixing the air and gases. It may be remarked, however, that with this particular boiler setting practically the same result would have been obtained in the latter instance had the extra air for this purpose as shown in the photograph Fig. 6. The several ruled areas numbered 1, 2, 3 and 4 are so laid off that they are 20, 40, 60, and 80 per cent black respectively. No. 0 is clear, or no smoke, and No. 5 is 100 per cent black. If the chart is placed at a distance from the observer the black lines cannot be distinguished and the several ruled areas appear as of varying shades, ranging from a light gray to an almost solid black. By placing the chart in line with the stack the observer is able at the instant when the observation is to be made, to glance from the stack to the chart and determine the number of the area on the chart corresponding in density to the escaping smoke.

As the public began to realize the extent of the damage from smoke and that the trouble from this source could be greatly reduced by the use of correctly designed and properly operated furnaces and equipment, a growing sentiment in favor of smoke abatement and smoke prevention manifested itself. A number of the larger cities have for nearly thirty years had ordinances prohibiting the emission of dense smoke. In scarcely any of these cities, however, except New York and Washington, where anthracite coal was almost exclusively used, was much attention paid to smoke or its prevention until a few years ago. At the present time there are at least sixty cities in the United States having some sort of statute to regulate the emission of smoke, but there is a general lack of appreciation of the fact that the smoke problem is an engineering one requiring a thorough knowledge of the combustion processes for its intelligent solution. The limits of furnace design within which smokeless combustion may be expected and beyond which dense smoke will result, are not to-day so clearly defined that the available information of this character may alone be depended upon. It is advisable to-day, if the coal smoke is to be reduced or abated, that the investor and the public be protected from the installation of equipment of such a character or in such a manner as to make smokeless operation impossible. This, and this only, is the reason for charging city officials with the duty of passing upon and approving or disapproving plans for furnace installations according as they are not properly designed for preventing smoke. It is therefore necessary, if desirable results are to be accomplished, that such officials shall have not only a knowledge of the relative value and the effect of the different methods of firing under any given conditions, but they must also know the effect produced by furnaces designed in different ways.

Realizing the impracticability of securing the services of a man who will from his own experience be able to correctly pass upon all such questions coming before him, some of our cities have, in their plans for the smoke-abatement work, made provision for consulting advice for the smoke inspector; and it is believed that wherever such provision has been made the advisability of such a course has been shown by the good accomplished. The result of all these various activities has been and must continue to be that those designing, selling, or installing furnaces will give more consideration to the prevention of smoke when new work, reconstruction or alterations are being contemplated. Many contracts for furnace equipment being signed to-day include a guarantee of smokeless operation, and the time will come when such a provision will be as generally included in contracts of this character as is now the specification of efficiency or capacity.



1. Equivalent to 20 per cent black. 2. Equivalent to 40 per cent black. 3. Equivalent to 60 per cent black. 4. Equivalent to 80 per cent black.

Fig. 7. Ringelmann's scale for grading the density of smoke.

This is a reduction of a smoke chart hung by the observer on a level with the eye, as nearly as possible in line with chimney. Glancing from smoke to chart, he notes the corresponding number, recording same and time of observation. He repeats the observations at one-fourth or one-half minute intervals. From these records the average density may be determined for each hour or for each day. No smoke is recorded as No. 0. 100 per cent black smoke is recorded as No. 5. Experienced observers often record in half chart numbers.

admission alone been employed. The amount of smoke emitted, duration and density considered, was under the one condition five times what it was under the other. A typical hand-fired boiler plant operating under smoke producing conditions is shown in Fig. 3. The photograph was taken a few moments after the fires were given one of the usual heavy spreadings of slack coal. Much of the smoke from these stacks could be prevented if proper methods of stoking were employed, and it could be further reduced by providing for the admission and mixing of extra air with the combustible gases immediately after firing. The two photographs, Figs. 4 and 5, taken from the report of the Chicago smoke department, 1911, illustrate the effect of a sufficient supply of air upon the emission of smoke from a locomotive. Although a period of only ten seconds elapsed between the taking of the two exposures, the smoke had entirely disappeared owing to the use of the stack blower (a steam jet in the smoke-box at the front end of the locomotive for the purpose of creating a draft when the engine is not in motion) and the combustion tubes (tubes to admit air into fire-box above the top of the fire and burn the smoke-producing gases). The statement made concerning hand-fired stationary boilers, that the method of firing has much to do with the amount of smoke emitted, is also true of locomotives. Furthermore, because of the rapid rate at which the fuel is consumed in a locomotive and the necessarily frequent coaling of the fire, the effect of improper methods is more pronounced.

Upon the question of the density of smoke opinions vary considerably unless there is some standard of comparison. The Ringelmann smoke chart, Fig. 7, is used

The Gould-Scientific American Prize Contest

THE SCIENTIFIC AMERICAN has made arrangements to hold the contest for the $15,000 prize offered by Mr. Edwin Gould through the SCIENTIFIC AMERICAN for a safe multi-motor flying machine, on the aviation field of the Hempstead Plains Aviation Company, Long Island. This field, adopted by the Aero Club of America as its official field, lies about one mile east of the hotel at Garden City. It provides a five-kilometer course and ample space for flying and the accommodation of the public. It is the consensus of opinion that a better field could hardly be found in the eastern part of the United States. The field lies in the heart of an open plain on Long Island and is free from tall structures, which might set up eddies, difficult for aviators to cope with.

The President of the Hempstead Plains Aviation Company will furnish free of charge for the contest and for one week preceding, not only the field, but also accommodations for the machines submitted for test. The entrants will, therefore, have an opportunity of trying out their machines and familiarizing themselves with the ground. Machines will be stored free for the week preceding the contest. Applications for storage space are to be made by the entrants to Mr. Douglas Houghton, General Manager of the Hempstead Plains Aviation Field, Garden City Hotel, Long Island.

The SCIENTIFIC AMERICAN is now proceeding with the formation of a contest committee, the names of whose members will be published later.

The following entries have been received from designers and firms who have declared their intention of participating in the contest:

Alleas Aeroplane Company, Boston, Mass.: Double biplane of the following-surface type.

Howard Gill, Boston, Mass.: Biplane.

H. Curtis, Manchester, Mass.: Burgess biplane.

The Boland Aeroplane and Motor Company, Rahway, N. J.: Biplane.

Edward J. Elsas, Kansas City, Mo.: Biplane.

H. W. Mattoni, 217 West 120th Street, New York: Multiplane.

Macleod Multiplane Company, Richmond, S. I.: Multiplane.

Charles H. Burleigh, South Brunswick, Maine: Multiplane.

George W. Beatty, Mineola, Long Island: Biplane.

Grover Cleveland Loening, on behalf of the Queen Monoplane Company, Fort George, New York: Monoplane.

John P. Conkling, 125 East 23rd Street, New York city: Biplane.

Turbine-electric Propulsion of Ships.—In a recent issue the advantages of electric propulsion of ships were referred to. The United States collier "Jupiter," now being built at the Mare Island navy yard, will be the first large vessel to be equipped for electric propulsion. A six-stage Curtis steam turbine, connected to a bipolar alternating current generator, supplies electrical energy to motors having 36 poles, thus reducing the synchronous speed in the ratio of 18 to 1. The "Jupiter" has two sister ships, the "Cyclops" and the "Neptune," which are equipped with triple-expansion reciprocating engines, and with a pair of steam turbines with gear reduction, respectively, and the performance of the first-mentioned vessel as compared with the other two will be awaited with interest.

The Enormous Fire Waste of the United States

How One Half a Billion Dollars Are Lost Annually Because of Bad Construction

By John L. Cochrane, Statistician of the United States Bureau of Mines

STATESMEN and politicians, many of whom take a superficial view of economic problems, have for some time been greatly puzzled over the constantly increasing cost of living. They have ascribed hundreds of reasons for the additional burdens that have been placed within recent years upon the people, but none of them have brought forth that the tremendous fire losses of the United States, unprecedented in any other country, have, with other similar industrial problems, had a vital influence upon the unsatisfactory present day conditions.

One reason, perhaps, why the fire loss has not been considered a factor is the impression that this loss is a natural and unavoidable one. With a recklessness that seems to characterize everything American, the annual report in a city on the fire loss is often taken as a matter of civic pride and if the report shows an increased loss over the year before, it is not considered a reflection upon the character of the structures in the city, on the efficiency of the fire department, but rather as evidence of the growth of the city itself, with more buildings that can be burned.

This complacent view, happily, is fast dissappearing and we are slowly coming to realize the true proportions of an immense problem that must be solved sooner or later. Perhaps the pioneer in this movement has been the National Conservation Commission which was created by Theodore Roosevelt, and which served as a Federal body until it was legislated out of office by Congress. This commission requested data concerning the fire waste and the task was given over to a branch of the United States Geological Survey, of which Dr. Joseph A. Holmes, now Director of the Bureau of Mines, was chief. A statistical inquiry covering the principal countries of the world, including a more detailed inquiry into the conditions in the United States was conducted by Mr. Herbert Wilson and the writer of this article and the results were given to the commission.

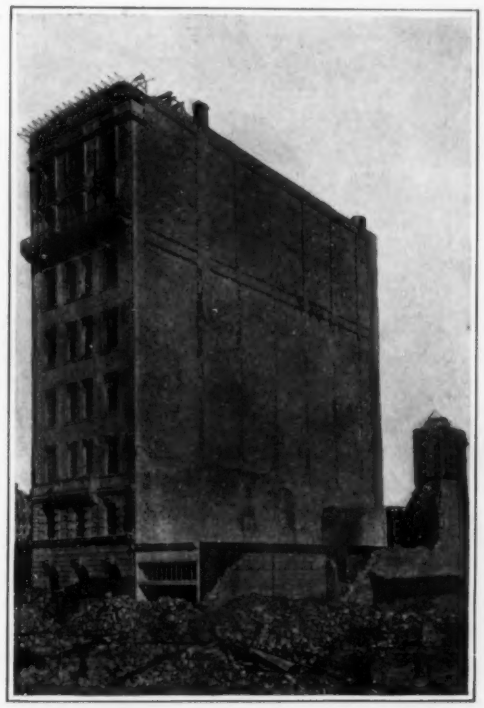
The inquiry disclosed that fires in the United States are costing us nearly half a billion dollars a year, or five times as much per capita as in any country of Europe. This is not only true of the actual waste of property destroyed, but also in the amount of insurance paid and the cost of fire departments. The total cost of fires in the United States in 1907, was $456,000,000, this including excess premiums over insurance paid, additional waterworks expenses, maintenance of fire departments and the cost of private fire protection.

The actual fire waste amounted to $215,000,000, which is a per capita loss for the year $2.51, as against thirty-three cents per capita in the six leading countries of Europe.

If we had the same building conditions as in Europe our fire waste would be but $41,000,000 instead of $215,000,000 and the total cost would be but $90,000,000 instead of $456,000,000.

In addition to the great property loss, the inquiry showed that we are also destroying in these fires five times as many human lives as are lost in other countries. In 1906, according to the United States Census, 6,000 persons died of burns in the United States and 10,000 were badly injured. Any comparison you may make of these statistics is startling. The cost of the fires in the United States in 1907 was equivalent to a tax upon the people exceeding the total value of the gold, silver, copper and petroleum production. The fire cost was greater than the true value of the real property and improvements in any one of the following states: Maine, West Virginia, North Carolina, North Dakota, Alabama, Louisiana, Montana. This means that the total destruction of the real property in any one of these States in a year would not represent a loss greater than that caused by fires in the whole United States.

The actual fire losses (the value of the property burned) are greater than the true value of the real



How a modern firepoof structure withstood flames. A really fireproof building prevents the spreading of a conflagration.

property either in the States of Utah, Delaware, Florida, Idaho, Wyoming or Nevada. If a storm or earthquake devastated any one of these States completely there would be a mighty outcry. Assistance would be rushed to the stricken people and a determined attempt would be made to find a remedy for the conditions, and the activity would not cease until the remedy had been found. But with the fires scattered throughout the country and the loss distributed among hundreds of cities there is but little appreciation of the seriousness of the conditions.

Another amazing fact is that the total yearly cost of fires is about half the value of the new building construction in the country. In other words, we are spending a billion dollars on new buildings and construction work while our fires cost half a billion dollars.

The inquiry that was undertaken by the Geological Survey brought out the probable cause of our enormous losses. An analysis of the figures obtained proved that much of the fire loss in this country was due to the fact that the fires extended beyond the limit of the buildings in which they started. It was found impossible from the figures obtained to give any definite statement as to the amount of the losses due to exposure, but some years ago prominent underwriters estimated that at least 27 per cent of the fire loss comes from fires that extend beyond the buildings in which they originate. These losses are undoubtedly due to the inflammable construction of buildings, for in Europe, where fireproof construction prevails, there is no such loss from this source, fires being more readily confined to the buildings in which they started. It is even more notable that only $68,000,000 of the loss in the United States in 1907 was on buildings of brick, concrete, stone and other slow-burning construction material, while double that amount, or about $148,000,000, was on frame buildings.

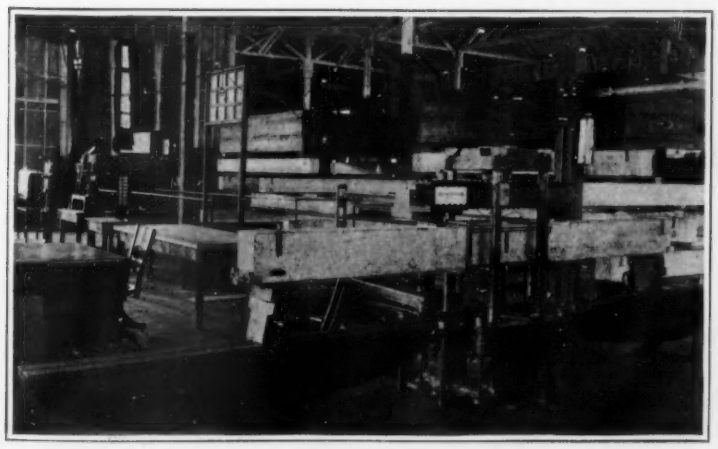
The inquiry as a whole tended to show that the construction of frame buildings inside the city limits and a general carelessness of construction methods were mainly responsible for the big losses. The fact that frame buildings are not allowed in European cities emphasized this fact. The frame buildings also are the cause of the great conflagrations in the United States. The National Fire Protection Association, in one of their official publications, recently said: "The average American city is full of fire traps. Buildings of great areas without fire cut-offs, with large floor openings, with unprotected windows, and with very combustible contents are too numerous to prove the exception to any rule. These are conflagration breeders. Fire travels through them rapidly and under certain conditions can get beyond even the best fire department, and, sweeping through the unprotected windows of surrounding buildings, will soon cause a conflagration."

The Ohio fire marshal in his annual report for 1907, in urging new building codes for Cleveland and Cincinnati, the two largest cities of the State, said: "Either city at any time may suffer a conflagration costing three hundred million dollars."

We have had such conflagrations in the past, as at Chicago in 1871; Boston, 1872; Baltimore, 1904; San Francisco, 1906, and Chelsia, Mass., 1908. The earthquake and fire at San Francisco resulted in a total property loss of $350,000,000, exceeding in amount that of any previous similar disaster in the history of the world.

We shall have conflagrations in the future, until our great cities are reconstructed along more thorough fireproof lines. We shall have these great losses until the city authorities refuse to allow a man to erect a building that is a menace to the entire community. And just as frequently as completely fireproof buildings are erected in the cities will the fire losses be reduced. These structures will stand as fire walls in the path of general conflagrations and keep them from spreading, as in the past. A sufficient number of these buildings, and conflagrations will be unknown. After that, the loss from fire will fall alone on the man who has a flimsily constructed building. To-day, it frequently happens that a man who erected a building a dozen or more years ago according to the best fireproof

(Continued on page 552.)



Testing concrete at the Government laboratories in Pittsburgh.

Clay products laboratory of the Federal Government at Pittsburgh.

Curiosities of Science and Invention

Conserving Energy in the Kitchen

A RESIDENT of Lewisburg, Pa., seeking to reduce as far as possible the drudgery of the kitchen work, has placed the coal bin for the range coal on the outside of the kitchen wall so that the coal will slide by gravity to a point convenient to the kitchen range. The bin is a pocket having a capacity of fifty or sixty cubic feet, and having room for from two to two and one half tons of coal. The floor of this bin which is covered with sheet iron to prevent the coal from sticking, is inclined from the side and rear at an angle of about forty five degrees toward a hole in the kitchen wall. Here there is a shelf to catch the coal and a beading fitted around it to prevent the coal from rolling off on to the kitchen floor. This shelf is located about twenty inches above the floor, so that the coal may easily be shoveled from the bin into the stove, without stooping. The opening in the wall is closed with a sliding door, which is shown in the illustration, and this fits so tightly that it stays up while the coal is being removed from the bin. The roof of the bin is binged so that it can be swung up like a door, and the upper portion of the siding is removable so that it will not be necessary to throw the coal to the full height of the bin until the bin is nearly filled. The top of the bin is eleven feet from the ground; hence, a man has no trouble in shoveling the coal in from the wagon. The device has proved a grand success. The coal is always just where it is needed and the fire never goes out because there is no coal in the scuttle, nor is too much coal ever put on the fire to empty the scuttle so that the man of the house may bring up the coal.

Another labor-saving device consists of an ash pit situated under the coal bin. The range is placed in the chimney and in the ash pan a hole is cut connected by a five-inch pipe with the ash pit. A damper in this pipe is turned every morning to empty the ashes accumulated the day before, and after this has run into the pit, the damper is closed, and the ashes in the grate are shaken down. Once a month the ashes are removed from the ash pit in about 15 minutes with no dirt in the house, as the door to the ash pit is located on the outside of the house.

Filling the outside coal bin.

The coal shelf right by the range.

The Parisian "Aviette" Contest

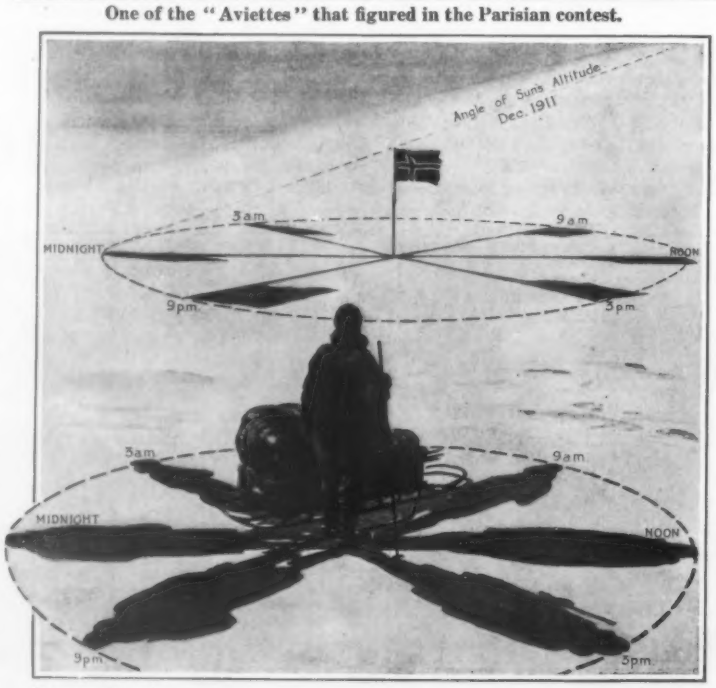
A CROWD of four thousand gathered at Pare des Princes on June 2nd to witness the first public competition of motorless flying machines for a prize of $2,000, offered to the first man who, in a flying machine depending on the motive power of muscular energy alone, would make the first flight of about eleven yards over marked ground between two chalk lines. There were nearly two hundred entries; but only about twenty-five men appeared. The prize was not won. As might be supposed, the "aviettes" were bicycles or tricycles fitted with wings with a propelier in front or behind. The conditions of the prize were published in the SCIENTIFIC AMERICAN recently. The prize was offered by the well-known manufacturer Peugeot.

Shadows at the South Pole

WHEN Capt. Amundsen planted the flag of Norway at the South Pole, he was virtually extending the axis of the earth, and if he did actually strike the exact pole, the shadow of the flagstaff must have described a perfect circle in a day of twenty-four hours, provided it fell on a level section of snow or ice. In other words, shadows do not vary in length from hour to hour at the pole, as they do in other parts of the world. This is shown graphically in the accompanying illustration taken from *The Sphere*. It might be supposed that this would afford a simple way of locating the South Pole, but much more accuracy is required than would be possible by measuring the shadows. As a matter of fact the shadows are not actually of a constant length at all times, but are ever varying with the declination of the sun. At the dawn of the six-month polar day the sun just peeps above the horizon circling slowly about the pole and rising at the same time in a slow spiral until at the end of three months it reaches an altitude of 23½ degrees on the 21st day of December which is noon of the South Polar day. At the dawn of the polar day the shadow of the flagstaff must stretch as far as the eye can see, but the end of the shadow will be describing a spiral, similar to the spiral described by the sun, and at noon of the polar day, when the sun is 23½ degrees above the horizon, the shadow will reach its minimum length of a little over twice the height of the flagstaff.

Monster serpent head excavated in Mexico.

One of the "Aviettes" that figured in the Parisian contest.



By courtesy of the *Sphere*.

How the shadows fall at the poles.

A Fine Specimen of Aztec Sculpture

AN excavation on the *calle de las Escalerillas*, city of Mexico, has yielded a prodigiously fine specimen of Aztec sculpture in stone. It was raised from the ground to the level of the driveway April 21st and reported at once to the Inspector-General of Monuments, who has provided for its early transfer to the National Museum. The size, the good modeling, and the perfectly chiseled detail of the monolith, which is a huge serpent's head, apparently a rattlesnake rank it with the finest Aztec sculptures that have come to light, not merely in the Federal District, but anywhere in Mexico. The men and wheel of our halftone engraving show the scale of the carving plainly enough. The reptile's head is entirely unbroken. It evidently lay flat on its base or pavement. Four perforations in its nose suggest its having been a fountain. The creature's round eyes show pupil and iris, and have good eyebrows. The dentate lips are parted in a suave reptilian smile. Four long poison fangs depend from its upper jaw and lie across the lower like a walrus' whiskers.

In default of the architectural data, one is at liberty to imagine two monster serpents of this type, with or without bodies, as flanking the doorway, or the stairway of some vanished temple, like the gold lions of Alkinoos in the Odyssey, or like the more familiar portal lions of ancient Oriental and Occidental art. Whoever knows the fantastical, dislocated serpent forms of Honduran art will marvel at the astonishing realism of this Mexican creation.

An Early Automobile

OUR attention has been called to the fact that in Rockland, Me., some very interesting experiments were made with a power wagon, thirty-five years ago. The machine was invented and built by Lemuel H. Parker, a blacksmith of about twenty-three years of age, who came to Rockland from Nova Scotia. He built the vehicle, including the engine, during his spare time, at his shop on Main Street. The work consumed two or three years. The body, it is said, was as long as that of the large touring car of to-day, and was hung very low on the axles. The wheels were solidly fastened to the axles in such a manner that corners were turned with difficulty. They had iron tires, and largely for this reason the machine was able to travel in dry weather on level ground or up a slight incline. Parker once took a trip of eight miles to Camden, which seems to have been his record. It seems that on his trips he always had a horse tied behind the vehicle. When he came to a hill, the horse was obliged to tow the machine to the top. The inventor's name was painted on the body of the automobile.

Power was derived from a steam engine of 10 horse-power, supplied with steam from a tubular boiler. The fuel was coal, stored in coal bunkers, on the top of which was room for four or five passengers. The speed was said to have been between four and five miles per hour on a good level road.

What Inventors Are Doing

Simple Patent Law; Patent Office News; Inventions New and Interesting

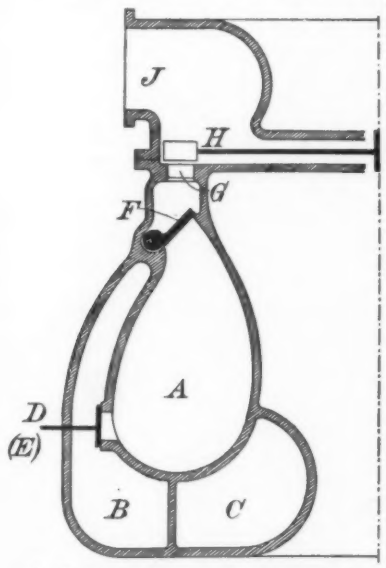
An Internal Combustion Turbine

By the Berlin Correspondent of the Scientific American

SOON after the advent of the steam turbine endeavors were made to solve the gas turbine problem, but none of the schemes so far suggested achieved any lasting success. It should be understood that the task of a gas turbine consists of liberating by combustion or explosion, the energy of gaseous (or liquid) fuel, in order afterward in a turbine wheel to cause this energy to act on a shaft driving a dynamo, propeller, pump, etc., without the intermediary of any mechanical parts. A gas turbine thus has to do the combined work of a steam turbine and boiler, just as a reciprocating gas engine does the duties both of a steam engine and steam boiler.

A most promising gas turbine has recently been invented by a German engineer, Mr. Hans Holzwarth, where the fuel energy is liberated *intermittently*, as in a reciprocating gas engine, and a 1,000 horsepower unit has already been constructed on this system.

The explosion chamber *A* is filled intermittently with a mixture of gas and air at relatively low pressure (½ to 1 atmosphere). After the ignition and explosion of this mixture, its increase in pressure throws open the nozzle valve *F*, allowing

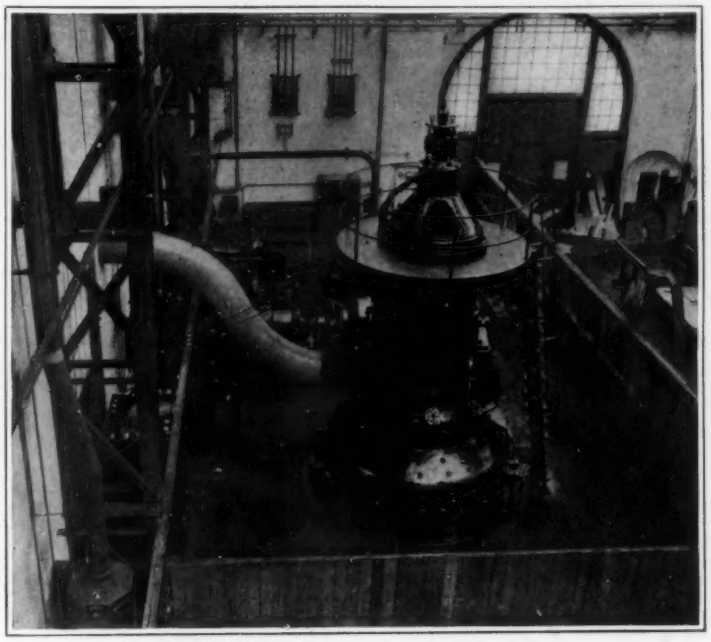


Section through one of the combustion chambers.

the compressed gases to flow through the nozzle *G* to the turbine wheel *H* on which the work is to be performed. While passing through the nozzle, the gases are expanded to the pressure of the exhaust *J*. The nozzle valve *F* is kept open by fresh air throughout the expansion and subsequent scavenging and cooling.

When the expansion has been completed, air is blown (or drawn) in at a slight pressure, through the valve *D*. This scavenging air throws any residual gases left in the combustion chamber, through the nozzle, into the exhaust, after which the nozzle valve and the air valve *D* are positively closed. The combustion chamber *A* thus is filled with pure, relatively cold air, into which the pure fuel (gas or atomized oil) is blown through the valve *E*, thus forming the explosive mixture destined to be ignited by sparks. In order to render the impulses thus imparted to the turbine-wheel more uniform, several combustion chambers working alternately in a given cadence are arranged in a circle round the turbine-wheel.

The auxiliary blower required for dealing with the combustion and scavenging air, and for compressing the fuel, uses up 10 to 15 per cent of the output, which is readily recovered from the exhaust gas heat. The photograph represents a 1,000 horse-power vertical gas turbo-dynamo with the blower set arranged sideways.

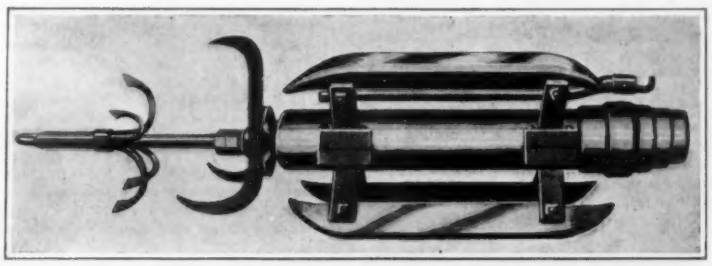


Turbine driven by the explosion of gaseous fuel.

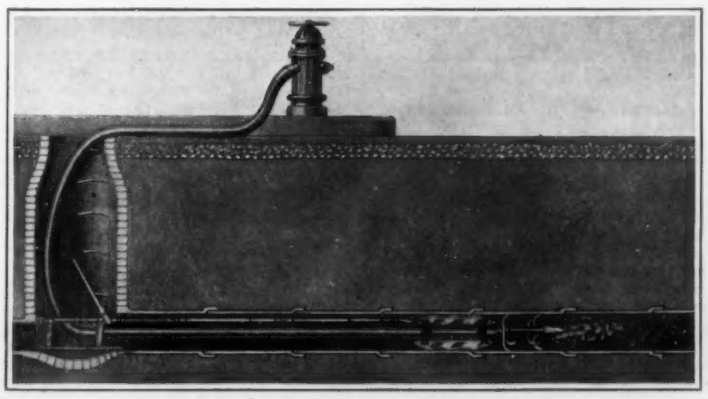
The most serious difficulty so far encountered in the gas turbine problem was due to the enormous temperatures, and all inventors therefore directed their attention toward the selection of a material capable of standing temperatures of 1,500 to 2,000 deg. Cent. There is no doubt that in a continuous combustion process the walls of the combustion chamber and the nozzle, in fact the whole of the turbine, are bound gradually to assume a temperature little below a white heat. If on the other hand the combustion chamber be water-cooled, by far the greater part of the available energy will be given off to the cooling water. However, in Holzwarth's intermittent turbine the walls of the explosion chamber, just as in a reciprocating gas engine, are exposed to high temperatures for only fractions of a second, and these walls are most effectually cooled by an intermittent air current (from inside) or if necessary by a continual water circulation (from outside). The heat losses resulting therefrom are of course incomparably lower than in connection with any gas turbine previously suggested, so that there is no objection to the use of the ordinary materials as otherwise employed in machine construction, such as cast iron and steel, for all parts of the turbine, inclusive of the nozzles and blades. As no drop of water is allowed to enter the turbine, no corroding effects are to be feared.

Actual tests have shown that any one of the usual power gases as well as atomized oil may be burnt most perfectly in the Holzwarth turbine. There is therefore an extensive field of application in store for the gas turbine both for stationary plants and on board ship.

While the safety of operation of the new gas turbine is in no way inferior to that of reciprocating gas engines, its efficiency seems to be even superior. The total weight of a stationary gas turbine plant, however, is only about a quarter of that of a gas engine plant.



Drag for cleaning sewers. A water-driven turbine revolves the cutting blades.



Turbine sewer cleaner pushing its way through a choked pipe.

An Early Perpetual Motion Proposition

THE Colonial and State papers in the office of the Secretary of State of Connecticut are rich in records of early invention and show that such State in colonial days and earlier was a leader in the number and importance of its inventions. It is but natural they should include a seeker for perpetual motion, who appears about 1785 or 1790 in the person of Harris Ransom of Colchester, who petitioned for full power and license, in effect a patent, upon his showing that at great expense, with much pains, labor and study, he had obtained the art or mystery of making a perpetual motion of water for raising water, etc.

Something About Keys

WE have read recently of the enormous heavy iron keys that are used in connection with ordinary door locks in some foreign countries. Have you ever thought of the tons of metal being carried about New York city, for instance, in the form of keys? We all carry bunches of keys and every key has its shank and handle loop. Why does not some one invent a more convenient device for carrying the keys in place of the form our fathers and grandfathers used? Again, if we have a number of keys, why shouldn't we combine them as shown in Fig. 1 and have a single shank with a key bit at each end of the shank, thus avoiding the weight of one shank and the handle loop for each two keys and make one bit serve as a handle by which to turn the others? Wouldn't the saving of weight in New York city alone aggregate tons? In the Yale style of key a form like Fig. 2 might be used, thus causing a single intermediate handle ring to serve for both key blades. There recently died in one of our American cities a musical eccentric who avoided carrying keys by having all the doors of his home supplied with combination locks. It would be almost as convenient to have all locks respond to one key.

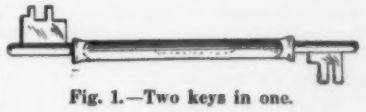


Fig. 1.—Two keys in one.

Fig. 2.—Double key for a Yale lock.

Sewer Cleaning Device

A UNIQUE sewer cleaning machine has recently been developed. It consists of a nozzle supported on runners which discharges through a small turbine water motor, causing one or two sets of hook-shaped blades to revolve rapidly. In so doing the blades stir up the dirt and sediment in the sewer to a thin grout, which the waste water from the turbine carries out. The machine is drawn slowly through the sewer by means of cables operated by windlasses.

A bucket shaped like a half cone and smaller in diameter than the sewer is first drawn through backward as far as possible over the dirt, then on pulling forward, the pull comes from the upper back corner of the bucket, and forces the digging edge to the bottom of the sewer. As it is drawn out it carries to the manhole not only the bucket full of dirt, but also a considerable amount of dirt, which is pushed ahead of the bucket.

The turbine with the knives is then introduced and connected with a water main. As the water is turned on the knives revolve and cut the fecal matter and roots in the sewer, and in this manner clean, sweep, and disinfect the sewer. There is a disinfectant cartridge in the turbine in paste form and as the water passes through the turbine it distributes the chemicals through the sewer. With a water pressure of 60 pounds the turbine generates three horse-power.

One of the illustrations shows the mode of operating the sewer turbine cleaning system when the sewer pipe is so completely stopped up that it is impossible to run cord or cable through it. The machine is inserted into the manhole at the low end of the sewer, attached to the hose and water plug, and with the water pressure the machine is allowed to work for a few minutes, in this manner cutting the matter out ahead of the machine. The machine under these conditions is connected with special coupling rods attached to a forcing jack, which may be operated to force the machine ahead as far as it has cleaned while in a stationary position. The matter cleaned in this way is ground up into a grout and together with the water is allowed to flow back past the machine and is carried away, leaving the sewer in a clean and sanitary condition.

Notes for Inventors

Reminding the Housekeeper.—In a patent, No. 1,026,768, Avis F. Rae of Chicago presents a housekeeper reminder in which a plate has an index of grocery and other commodities and a series of pointers are mounted on straight rods alongside the index and pivoted so they can be turned to indicate their respective commodities and thus remind the housekeeper of the groceries, etc., which are required.

Convict Inventor on His Honor.—A western newspaper account tells of the release by Gov. Hunt of Arizona on his own recognizance for a period of thirty days of a convict inventor. The release was made to permit him to visit Washington with a view to securing patents for several inventions invented or completed while he was confined in the penitentiary. His inventions are said to relate to means for assembling electricity from the surrounding air, a trolley protector, a flying machine and its engine.

Legal Notes

The Gillette Patent Upheld.—The U. S. Circuit Court of Appeals in the case of Clark Blade and Razor Company v. Gillette Safety Razor Company, 194 Fed. Rep., 421, has held the Gillette patent, No. 775,134, for a safety razor valid and infringed.

Delay Because of Illness.—In the case of *Ex parte* Palmer, decided by Assistant Commissioner Billings, it is held the delay in filing an application for reissue was sufficiently accounted for and not unreasonable, the facts being as appears from the oath of the applicant that he had started to learn the scope of his patent before the expiration of the two years but that his activities were delayed because of illness which required him to leave his business and to travel. It does not appear that there are any intervening rights existing or any proposed infringement suits which urged him into activity in filing a reissue.

The Mead Design Adjudicated.—The *Patent Office Gazette* of May 28th, 1912, contains the reports of adjudications of the Mead design patent, No. 39,247, for a design for a neck scarf. In five cases reported in 194 Fed. Rep., pages 696 to 708, the patent is held void for lack of invention and novelty in one case; void for anticipation in two cases; valid and infringed on motion for preliminary injunction in one case and not anticipated, valid and infringed in another case. The Mead patent, No. 963,235, for a neck scarf is held in one case, 194 Fed. Rep., 717, not anticipated, valid and infringed; and in another case, 194 Fed. Rep., 721, the patent is held void for anticipation.

RECENTLY PATENTED INVENTIONS

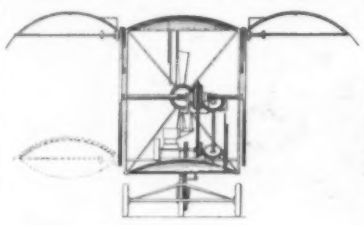
These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

HAT HOLDER.—L. VIEZZI, 606 Palisade Ave., Jersey City, N. J. This holder is for holding ladies' hats securely in place on the head, and is arranged to permit the user to readily place it in position in the hair and engage the retaining devices of the holder with the lining of the hat, or to release the said retaining devices on removing the hat.

Pertaining to Aviation.

FLYING MACHINE.—M. M. BENSTER, Gettysburg, S. D. An object of this inventor is to provide a flying machine with a plurality of wings adapted to be swung through the air, to simultaneously raise and propel the machine. A still further object is to provide



FLYING MACHINE

a machine with propelling means, and with mechanism for driving the same, the mechanism having an auxiliary driving connection whereby an accidental breakage may happen without destroying the flight of the aeroplane. The machine is shown herewith in a front end view in elevation.

EQUIPOISER.—G. HIPWOOD and P. EGAN, care of G. Hipwood, 145 W. 61st St., New York, N. Y. This invention relates to an attachment for a flying machine, whereby the poise or balance of the machine may be maintained under varying conditions, in such a way that there will be little or no danger to the operator if the engine, propeller, or controlling devices should break down.

Of Interest to Farmers.

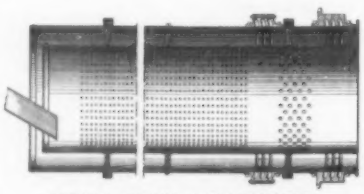
CLEANING ATTACHMENT FOR HARROWS.—H. E. SMOCK, Matawan, Monmouth Co., N. J. The object here is to provide an attachment for harrows arranged to permit convenient raising of the harrow as the latter is dragged over the ground, to permit the gathered-up weeds, brush, straw and the like, to drop off the harrow, thus cleaning the same of the accumulated matter.

Of General Interest.

SPRING FRAME FOR CUSHION SEATS.—A. WEICKMAN, 342 E. 53rd St., Manhattan, New York, N. Y. This inventor aims to provide a novel framework comprising a number of resiliently-connected parts which can be upholstered and covered to give the effect desired. The cushion body is supported on wires, and owing to the provision of springs the result is a very comfortable seat for the user.

CONCRETE BUILDING APPARATUS.—H. W. FULLER, Seiling, Okla. An object here is to provide improvements that consist mainly in the means for fastening the corners of the mold together, improvements in the shape of the core blocks, the simplifying of the construction of the adjustable molds, and other new features. The device is an improvement over that shown in a prior application made by Mr. Fuller.

SEPARATOR AND AMALGAMATOR.—J. WICK, Hotel Richelieu, 201 Occidental Ave., Seattle, Wash. Mr. Wick's invention comprises a revolving screen employing certain improvements for use in the mining of gold and other precious metals. It is especially adapted for



SEPARATOR AND AMALGAMATOR

use in connection with gold dredging machinery, but it will also work to advantage in quartz mills and other mining installations. By means of this apparatus all the work can be done that is now performed by ordinary screens, separators, cables and sluice boxes; thus dispensing with much of the cumbrous apparatus kept in common use. The accompanying engraving shows a longitudinal vertical section of the combined screen with the amalgamating devices attached.

TURPENTINE GATHERER.—J. H. WOMACK, P. O. Box 153, Kentwood, La. This invention is an improvement in turpentine-gatherers which consist of two principal parts, namely, a sheet metal spout or apron which is affixed to the tree trunk below the scores in the bark, and a cup or box-like receptacle which is suspended detachably from the spout.

Hardware and Tools.

PIPE REAMER.—J. R. DESJARDINS, 33 Webster St., Fall River, Mass. In this case use is made of a main reamer and an auxiliary reamer, the latter being fixed on a rod, and the main reamer being adapted to be clamped in place on the rod, the main reamer having a large bore for the passage of the rod and for allowing the rod to assume an angular position relative to the axis of the main reamer.

ERASER HOLDER.—T. P. KRUGER, 980 Simpson St., Bronx, New York, N. Y. This holder is arranged to accommodate an eraser strip for ink, or one for pencil, or both, one at each end to securely hold the eraser strip in position on the holder, and to permit of adjusting the strip in the holder, to project the strip the desired distance from the end of the holder, to allow a proper and economical use of the eraser strip.

CAN OPENER AND SEALER.—F. E. TEVES, care of Humboldt Mfg Co., Humboldt St., near Calejer St., Brooklyn, N. Y. It is an object of this invention to provide a can opener which will provide a plurality of openings in the can so that the milk can be poured out, and which is also of such a form that when reinserted in these openings, it will exactly fill them, so as to form a practically air-tight sealer that will keep the milk a greater length of time.

BUCKLE.—A. BIENENZUCHT, 109 Spring St., New York, N. Y. The aim here is to provide a tongueless buckle for use on belts, straps and like articles, and arranged to permit of adjusting the belt to fit the wearer, to securely hold the belt in adjusted position, and to allow quick release of the belt whenever desired to open the belt.

VISE.—L. VIEZZI, 606 Palisade Ave., Jersey City, N. J. This vise has a jaw with an arm in a guideway, the arm extending through an opening in a lever fulcrumed to a beam held in one direction by a spring, the lever gripping the arm, and means are provided for operating the lever, to permit the arm on the jaw to move through the opening in the lever and to move the beam and with it the lever, arm and jaw, so also that when freed the spring may throw the beam back and with it the lever, arm and jaw, to obtain a firm grip.

SCREW DRIVER.—I. L. MESSENGER, care of R. D. Burdick, Lincklaen Center, N. Y. Among the principal objects this invention has in view are to provide a tool having gripping jaws to hold a screw while the same is being driven; and to provide jaws of the character named having extended ends arranged for reaming a seat for the screw head.

Heating and Lighting.

CANDLE HOLDER.—J. P. RAOUX, care of Mons, l'Abbe J. P. Raoux, Salins, near Mauriac, Cantal, France. Means here are arranged to securely hold a candle in place, to allow of burning it to the very end, to readily accommodate candles of different diameters, and to permit of fastening the holder to a suitable support with a view to hold the candle in an upright position and thus insure proper burning of the same.

SMELTER FURNACE.—W. M. NESBIT and E. PIKE, care of E. Pike, Eureka, Utah. For the purpose of reducing metal bearing ores, use is made of a stack in the wall with inlets below the smelting zone, and means for producing a central suction in the top of the stack so that air, pulverized coal, coke or charcoal, or liquid or gaseous fuel is drawn through the said inlets into the stack and the products of combustion are drawn out of the stack.

AIR-HEATING APPARATUS.—A. E. JONES, Fiume, Austria-Hungary. This invention relates to devices for injecting water into the hot combustion products in an air heating apparatus such as used in the propulsion of torpedoes, as in British patent 3,495 of 1905. The object of this invention is to automatically regulate the quantity of water forced into the hot combustion products, so that it always bears the proper proportion to the amount of fuel injected into and burned in the combustion chamber.

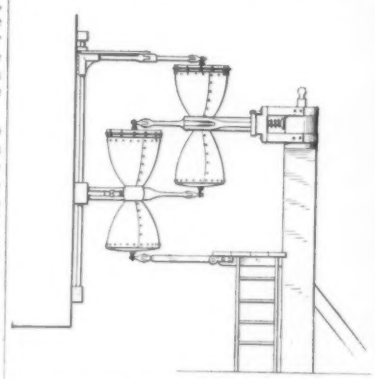
SHADE HOLDER FOR INCANDESCENT LAMPS.—H. H. PALMER, 64 Columbus St., Charleston, S. C. This improvement pertains to holders which are attachable by one end of the neck of an incandescent lamp socket, and have means at the other end for detachably engaging a shade and thus securing the shade to the socket. The invention relates particularly to the means of securing the holder to the shade.

Household Utilities.

FLOAT CONTROLLED VALVE.—J. F. YOUNG, 430 S. Cedar St., Owatonna, Minn. The improvement refers to float controlled valves such as are suitable for use in connection with toilets, the more particular purpose being to provide an inlet valve which is sure in action as well as noiseless and which presents a number of distinct advantages.

Railways and Their Accessories.

MAIL BAG DELIVERY MECHANISM.—B. F. NICOLL, 4439 So. Liberty St., New Orleans, La. The invention comprises automatic means for handling mail bags, and its object is to facilitate the delivery of mail with speed and despatch to and from trains running at a high rate of speed past stations where no stop is scheduled, and posts and other points along



MAIL BAG DELIVERY MECHANISM

the route. A number of automatic hooks suitably mounted on the side of the mail car, and upon suitable fixed supports beside the track, the hooks being adjustable, so that they can be swung into position to hold the bags in the manner required to receive and deliver the same whenever a train passes. The engraving shows a front elevation of the mail-delivery mechanism viewed from the direction in which the train is going.

RAIL JOINT.—W. H. WILTSHIRE, Gillespieville, Ohio. This invention is an improvement in rail joints, and the object thereof is to provide a construction of this type which will enable the ends of the rails to be slipped together, one on the other, to make a rigid connection, and at the same time keep the top surface of rail practically continuous.

Pertaining to Vehicles.

AUTOMOBILE BANK VEHICLE.—D. H. BELLAMORE, 622 W. 114th St., Manhattan, New York, N. Y. Among numerous features, this invention provides for sounding an alarm in a vehicle on any attempt to feloniously enter the interior; provides a vehicle for itinerant banking purposes, the walls being electrically connected when penetrated by any metallic substance or twisted to form an entering space; provides for ejecting from the cashier's window any menacing persons; and provides means for sounding an alarm if the attendant is attacked or car run away with or when the entrance door is opened.

AIR PUMP.—G. J. SPOHRER, Franklin, Pa. This invention relates to an improved form of air compression pump, and more particularly relates to that form of air pump adapted to be installed on an automobile or other road vehicle in which the compresed air is used to actuate an engine starting mechanism, or for other purposes.

Designs.

DESIGN FOR A PORTFOLIO COVER.—E. F. CALDWELL, care of E. F. Caldwell & Co., 356 W. 15th St., Manhattan, N. Y. This ornamental design shows a slightly elongated form of cover of black ground tooled in with lines depicting scrolls, flowers, figures, etc., in exquisitely-wrought combinations massed around a broad border, and in a centerpiece.

DESIGN FOR A BOTTLE OR SIMILAR RECEPTACLE.—E. PALMER, 374 Pearl St., New York, N. Y. This plainly ornamental design shows two perspective views, one of the front and one of the rear of the bottles, the former showing two panels and the latter one.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

How 200,000 Motor Car Owners

Have Created an Avalanche of Trade for

No-Rim-Cut Tires 10% Oversize

Users told others—and the others told others—that these patented tires cut their tire bills in two. That is the only reason why these tires jumped to

The Topmost Place in Tiredom

It Took 10 Years to Perfect It

Here is a tire which remained for ten years in obscurity, while our experts worked to perfect it.

Then users found it out, and the demand for this tire suddenly changed from a rivulet to a flood.

Last year we sold more Goodyear tires than in the previous 12 years put together.

Over 1,100,000 have now been used, and the present demand is immensely larger than any other tire ever knew.

With our mammoth capacity—with our factories running 24 hours per day—we are four weeks behind on our orders.

Don't Deceive Yourself

That is the situation now—in the 13th year of the Goodyear tire.

That is the verdict, after 200,000 motor car owners have actually tried these tires.

Don't say this demand is a passing sensation, due to good salesmanship. Don't deceive yourself by assuming that other tires offer an equal advantage.

Such an army of users—200,000 strong—can't be fooled on tires. Our success is due solely to what they are telling other men about them.

Finality in Tires

Goodyear tires, in their construction, represent finality in tires.

We say this after 13 years. During that time we have compared some 200 fabrics—some 40 formulas for treads. We have compared every material, every method and process which experts have ever devised.

We have done this on testing machines in our factory—where four tires at a time are constantly worn out under all sorts of road conditions, while meters record the mileage.

After all these tests—after 13 years—we know that these tires come as close to perfection as men can ever hope to get.

Saving 48 Per Cent

These perfected tires, by a patented process, are made so that rim-cutting is ended forever. This type is called the Goodyear No-Rim-Cut tire.

Statistics show that 23 per cent of ruined old-type tires are rim-cut. No-Rim-Cut tires save that 23 per cent.

Then these patent tires—No-Rim-Cut tires—are made 10 per cent over the rated size.

That means 10 per cent more air—10 per cent added carrying capacity. And that, under average conditions, adds 25 per cent to the tire mileage.

So No-Rim-Cut tires save that 23, plus that 25 per cent. Tens of thousands of motorists have proved this.

8½ Per Cent Profit

Yet No-Rim-Cut tires cost practically the same as other standard tires. They used to cost one-fifth extra.

Our multiplied output has cut the cost of production, and we have cut our profits. Last year our profit on No-Rim-Cut tires was only 8½ per cent.

Those are the reasons why No-Rim-Cut tires outsell all other tires. Why 200,000 men have already adopted them. Why 127 motor car makers have this year contracted for Goodyear tires. And why more than one-third of all Show cars this year were equipped with these premier tires.

You are bound to come to them, but while you are waiting your tire upkeep is doubled. Ask any man who knows.

Our 1912 Tire Book—based on 13 years of tire making—is filled with facts you should know. Ask us to mail it to you.

GOODYEAR
AKRON, OHIO

No-Rim-Cut Tires

With or Without Non-Skid Treads

THE GOODYEAR TIRE & RUBBER COMPANY, Akron, Ohio

Branches and Agencies in 103 Principal Cities
More Service Stations Than Any Other Tire

We Make All Kinds of Rubber Tires, Tire Accessories and Repair Outfits
Main Canadian Office, Toronto, Ont.—Canadian Factory, Bowmanville, Ont.

(642) (642)

Industrial Uses of Moving Pictures

(*Concluded from page 538.*)

machine. Moving pictures have solved the problem which confronted people whose product is too cumbersome or heavy to be easily transported. A reel of moving pictures is conveniently portable; it weighs about eight pounds. The film is of standard size and runs in any of the various projecting machines, and there is hardly a hamlet where a moving picture machine is not available.

A number of railway companies are using, with great success, moving pictures to attract homeseekers and tourists. The subjects selected for this purpose show the prosperity and natural resources of a State or territory, the comforts of travel, scenic beauties of a section, the advantages of a health or pleasure resort. These pictures are exhibited usually in connection with a lecture and are shown before people most likely, and financially able, to respond to their advertising appeal. They encourage travel by disclosing its pleasures; care is taken that the name of the railroad doing the advertising is identified effectively.

Manufacturers who make advertising capital of the care with which their goods are made, the magnitude of their plants, or their general manufacturing facilities, are using moving pictures to pictorially prove their assertions.

For instance, a big clothing house in the middle West have, for years, extensively advertised the fact that they manufacture, under their personal direction, boys and young men's clothing, and that from the time the wool is taken from the sheep until it becomes the finished garment their jurisdiction prevails. When the idea was first presented to them by a moving picture advertising expert, it gained their immediate favor. "But," said they, "we must first feel out our customers and find out whether in their opinion such a film would benefit their sales as well as give publicity to our name." Letters were sent out to over two hundred merchants who handled this particular line in different parts of the United States. By return mail the answers came in, and they kept coming until each and every merchant queried had responded, and every merchant branded the idea as "great" and said, in effect, "send us the film and it will help us send you more orders." The film was made. Starting with the herding of the sheep, it shows sheep shearing, sorting and packing the wool, follows the wool through the mills until it is made into cloth, showing the cloth being shrunk by the cold water process, and then illustrates every important detail of clothes construction. The final scene shows the interior of a retail store where customers enter to select this particular make of garment because their inspection and comparison influence their decision. What is the result? Those who see this film are taken on a trip through a factory which impresses them as a model of its kind. This causes them to believe in a product so honestly advertised and to remember the name of this particular manufacturer whenever they are in the market for clothes.

This idea has also been practically tried out by a big shoe company, a soap manufacturer, a firm manufacturing a well-known breakfast food, and many others whose propositions and claims would stand for pictorial proof, and the proof would directly or indirectly add to their prestige or sales.

A number of Chambers of Commerce, Business Men's Leagues and other civic organizations, interested in the exploitation of the cities they represented, have used, and are now using, moving pictures to attract residents, visitors and capital. In advertising a city the moving pictures are made to show the industrial and business activities, street scenes, the school facilities, churches, social life, parks, and those points of interest, business or beauty which would attract one who contemplates a change of residence, a visit, or, an investment. The cities using moving pictures in this manner are entirely satisfied with

the results they have secured, and are securing, and the people who respond to this class of municipal advertising make advisedly any move the pictures actuate and know definitely what to expect when they visit the place to which the moving pictures have attracted them. Moving picture advertising of this kind minimizes disappointments and discourages misrepresentation.

To make moving pictures that can advertise, the subject must be treated along the same lines as a piece of copy is arranged for printed publication. The scenes must be attractive, they must have a maximum of interest and a minimum of irrelevancy or dead action. An advertising film must pictorially tell its story in logical sequence and lead up logically to the point where the advertising effect is obtained most tellingly. Accuracy must not be sacrificed for dramatic effect and yet the commercial appeal should be presented so as to be not too blunt. The greatest value is where the advertising message is so delivered that the consumer's buying instinct is aroused while he is being entertained.

How We Can Utilize Wasted Timber

(Concluded from page 537.)

It has been determined that timber, particularly when fire-killed, does not appreciably deteriorate for a considerable length of time. Even though decay sets in it does not affect the timber to such an extent that it can not be utilized for some purpose or other during the first five years. For instance, timber above 9,000 feet elevation has been used after more than 50 years have elapsed since burning. Vast quantities of timber in the West killed from 20 to 30 years ago are now almost free from decay and are being used for many purposes. Some species decay much sooner than others after being killed, but it can be safely assumed that timber on an average lasts for five years after it is killed. Granting that the conservative estimate of 100,000,000,000 feet of dead and down timber represents the average annual amount since 1906, it will be easy to figure out that the total amount of waste for the past 5 years is about 500,000,000,000 feet which should have been turned to some economic use.

The value of the dead and down timber cannot be ascertained because so much depends upon the species, accessibility, size, and character of the trees, proximity to market, amount available, etc. Data regarding the value of dead timber have been supplied by Forest officers in the different States in which it occurs. Even with these figures, which cover the greater part of the forested regions, it is not possible to arrive at a fair average value. The prices at which dead timber has been sold vary from 50 cents to $26.00 per thousand board feet. If the lowest figure reported is accepted as a fair average value per thousand the aggregate value would be about $250,000,000. Much useful information regarding the value of dead timber will be secured as soon as a better demand for the wood can be created.

The United States Forest Service made a great many tests which show that sound dead timber is almost as strong as seasoned green timber and that it is much stronger than green timber before seasoning. The relative strength of green and dead white fir is given in the following table:

Relative Strength of Green and Dead White Fir.

	Number of Tests.	Moisture, Per Cent.	Fiber Stress at Elastic Limit, Pounds per Square Inch.	Crushing Strength Pounds per Square Inch.
Green timber....	97	47.9	2,370	2,595
Dead timber.....	58	13.6	4,459	4,824

In order to make the comparison a fair one the green and the dead pieces that

were tested were first brought to the same condition of seasoning, and when this was done the tests indicated that dead white fir is about nine-tenths as strong as green white fir thoroughly seasoned and about twice as strong as green timber freshly cut. There is no reason, therefore, why dead timber that is in a good state of preservation should not be as valuable as green timber for a good many purposes. A large portion of the wood calculated in the estimates of dead and down timber, especially that in the remote forests of the eastern hardwood districts, is practically unfit for anything else except for fuel. On account of lack of transportation facilities it is impossible now to bring this material to market. Fire-killed trees in the Western and Southern yellow pine districts often furnish good, heavy logs within easy reach of a shipping point. Material of this kind whose value is not impaired should yield a price equally as good as that from green trees.

The United States Forest Service has paid especial attention to devising methods of turning into useful products the tops, slabs, and other waste of sawmills, which at present are often a total loss. One of these means of utilizing waste is the application of wood distillation. Any wood rich in resinous products can be used, and the very best results are obtained from the down timber and stump in the cut-over pine forests. Most of the lumbermen have timber holdings which contain material suitable for distillation. The great sawmills which cut coniferous wood have a large proportion of such material in slabs which have no use for any other purpose. By using the dead and down timber in the woods the fire risk is greatly reduced, since any and all material suitable for wood distillation is necessarily of the most inflammable nature. In many cases even the roots, as well as the stumps, are used, which greatly lowers the cost of clearing land for farming purposes.

In parts of the South the dead pine wood, including stumps, tops and mill waste, is utilized for making tar, turpentine and charcoal. The wood is collected in the forest and on cut-over land and put in a heap in a hole in the ground and covered with dirt and sod. Fire is then started at the bottom and allowed to smolder until all the wood has turned to charcoal. In a few cases regular kilns resembling the old-style of Swedish lime kilns have been constructed for this purpose. During this charring process, which sometimes requires 8 or 10 days, considerable tar is driven off and collected. One cord of pitchy pine wood on an average produces about 40 gallons of tar.

In one plant near Jacksonville, Fla., the light wood is put through a process of dry distillation for the spirits of turpentine it contains. From 12 to 16 gallons of turpentine are thus obtained from one cord of wood. After the wood is taken out of the ovens it is placed in the kilns where the tar is driven off and the wood converted into charcoal. The best grades of charcoal are obtained by this process, and large quantities are made every year. The product known as oil of tar is obtained by distillation of the tar. Sawdust and other waste incident to milling carry a heavy percentage of wood alcohol and creosote. Mill waste is now being used on a small scale in the Southern pine belt, but it has not proved very profitable thus far. It is hoped that all the mill waste will be utilized eventually for these by-products. The wood preferred for making turpentine is that which is obtained from old stumps. Many millions of cubic feet of the richest stump wood is available in the South, and it can be used very profitably.

The rapid disappearance of spruce and balsam in New England has forced pulp makers to use dead wood more and more and has brought material once considered entirely useless on a par with the green wood. The amount of dead wood now used depends entirely on the supply. Pulp makers find it superior to green wood in the sulphite process. In the Middle and Southern States fire-killed hardwoods

PORTLAND CEMENT MAKING is described in excellent articles contained in Scientific American Supplements 1433, 1465, 1466, 1510, 1511. Price 10 cents each. For sale by Munn & Co., Inc., and all newsdealers.

By-Products of the Packing House

(Concluded from page 538.)

used by the oleomargarine industry; the residue left in the cloths is the stearine which has the highest melting point of any animal fat, and is of prime importance in the making of compound. Oleo oil is one of the main constituents of oleomargarine, and possibly comes nearest to the ideal fat for this purpose on account of purity and flavor. There are several grades made, all of which show a low percentage of free fatty acids, under three quarters of one per cent, indicating that they have been removed from the body tissue with practically no

are now largely utilized for charcoal.

Large bodies of fire-killed timber in the West are now cut for fence posts. The demand for durable fence posts by ranchmen has hitherto been met by the use of red cedar (*Juniperus*), but its supply is now almost completely exhausted in a good many localities. The average life of a red cedar post is about 20 years, while other species last only from 3 to 10 years. Fire-killed lodgepole pine, when properly treated, will last equally as long as red cedar. The Forest Service has demonstrated that dead timber treated with preservatives may be utilized at a moderate cost when compared with red cedar posts, which are expensive. Enormous quantities of dead timber in the West are being disposed of each year, which will considerably reduce the drain upon the forests. The removal of this material leads to the improvement of conditions in the forests, because it lessens the fire hazard and insures quicker and better crops of young trees.

In extensive burns in the West fire-killed timber is often the only kind available. Its chief uses are for stulls, lagging, fuel, house logs, lumber, mine props and railroad ties. In proximity to a mine or to a spur of a railroad, dead wood has been used for many years for mine timbers and for cross-ties. For mine props all species are used. In Colorado one mine alone uses approximately 4,500,000 board feet of dead timber every year. There are a great many mining camps that use dead timber exclusively because of its lightness, durability, stiffness, all due principally to its better seasoning. For many purposes fire-killed timber is preferred to green timber because it is thoroughly seasoned and is in excellent condition for preservative treatment, as the moisture has completely evaporated, which gives it more durability than green timber. It also renders it lighter so that transportation charges are less. In parts of Colorado burned timber of all kinds is made into ties, some of the material having been burned over 50 years ago. This timber is still standing on the stump and is said to be almost as hard as flint and very durable. The species used are red fir, yellow pine, lodgepole pine, limber pine, Engelmann spruce and blue spruce. It is asserted that dry ties last in many cases longer than green ties. They hold a spark better, and a tie plate does not cut into the wood so seriously as it does in the case of a green tie.

Telephone poles from fire-killed timber have been used with excellent results, and in 1903 a box factory in Colorado began the utilization of dead timber. The species accepted for this purpose are Engelmann spruce, lodgepole pine, and red fir. It was discovered that fire seasoning had driven the odor out of the dead pine wood and that it could be used advantageously for packing crackers and biscuits. Fruit growers in Oregon and Washington also prefer the wood from fire-killed pines for the reason that it is almost odorless, and, therefore, does not impart an unnatural odor to the fruit. On account of the perfect seasoning the packing boxes will remain tight when put up, which is another important reason why dead wood is more desirable than green wood. It is believed that dead timber will soon be employed successfully for a good many other purposes, which will reduce eventually the amount of waste to a minimum.

alteration chemically. The stearine on account of its high melting point is admirably suited for mixing with refined cotton seed oil to give it the necessary firmness for lard substitutes.

The fat obtained from the hog is usually classed as kettle rendered, prime steam, and neutral lard, the latter being the best grade. It is made from the leaf and contains practically no free fatty acids. It is analogous to oleo stock, and like it finds its greatest use as another one of the ingredients of oleomargarine.

The various internal organs such as tongues, brains, sweetbreads or pancreas, and the heart, lungs, and liver, which are known as plucks, the kidneys and the tripe, need be but mentioned as forming good edible by-products which have always been held in esteem. The various trimmings which include the weasands, ox lips, hog ears, snouts and tails, and the cheek meats are also edible products, some of which are cured. Here also we find blood being used for making what is called blood sausage. And we must not forget the pickled pigs' feet. Another valuable adjunct to the list of edible materials which indicates good utilization is beef extract, a product which has found considerable favor for condimental purposes; and with this we shall pass on to a consideration of the inedible products which are of great importance in the industrial world.

The inedible portions constitute the external covering, some of the offal and the skeleton or bones. At first glance one does not get the possibilities which have been realized with these as a basis. Enormous industries by themselves, such as the leather, soap, glue, and fertilizer industries, are dependent upon the use of the above substances. The entire leather business with its many ramifications is one of the instances of the early employment of so-called waste materials. From the hides of cattle the shoe industry has risen as well as the manufacture of leather belting, harnesses, and fancy leather articles of divers' kinds. The waste from the leather or from the untanned hides finds use as glue stock, while the tanned leather buffings and trimmings find their way into the fertilizer factories, where their nitrogen content make them valuable after suitable chemical treatment. The hair from the hides goes to the dealers in plastering materials and for fertilizer, hair felt and insulating material. The sheep skins and the hog skins are also converted into leather, although the latter not very extensively. The hog hair and bristles are finding increased use, especially the former, since the rapid development of the automobile business has required many hair cushions and padding. The hair for this purpose is first put through a fermentation process which removes an outer coating; it is then dried and dyed, when it has a value in excess of what it once brought as fertilizer. Screenings from the hair factory can be and are being made into a substance known as retarder, which is used by the makers of plaster of paris to retard the setting time of their product.

The wool derived from the sheep pelts aids materially as a profit producer, but before it can be subjected to any manufacturing process, raw wool must be washed and scoured to remove impurities, which are present sometimes to the extent of over half of the total weight. These consist of the wool grease and the suint which exudes from the body of the animal with the perspiration, and consists mainly of potassium salts of various fatty acids together with other inorganic and nitrogenous bodies. In some places these materials are recovered and worked up into useful products. Thus, the wool grease is used as a lubricator and in leather dressing; or by proper purification it can be made into lanolin, which is much used in pharmacy as a basis for salves, ointments, and emulsions. The water containing the suint can be evaporated directly and calcined to recover the potash which amounts to from 1 to 8 per cent of the weight of the wool.

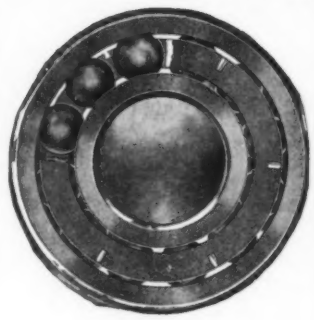
The horns and hoofs of cattle and sheep and the hoofs of hogs are similar in chemical composition to hair, being highly nitrogenous in character. The uses to which these articles are put are both ornamental and useful; the horns are made into such things as foot stool legs, various holders and ornaments; the hoofs, when polished and filled, make beautiful pin cushions. Besides these more or less ornamental objects there is derived a line of articles for more personal use such as buttons, hair pins, side combs, knife handles, and horn spatulas used by chemists. The poorer shapes of horns and hoofs are turned over to the fertilizer factory, where they are finely ground and sold as fertilizer. This brings us to the discussion of the working up of the inedible offal.

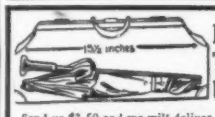
In the term offal is included all edible parts, aside from dressed meats, and the blood and all internal parts which are inedible, and also some external parts. The blood, which we shall consider first, is pumped directly from the killing floor to the fertilizer factory, especially that obtained from the hog and sheep. Here it is cooked, pressed and then dried, after which it is sold direct as nitrogenous material or mixed in commercial fertilizer. Some of it finds use as a stock food in the form of soluble blood flour. In some plants the beef blood is caught in pans for the preparation of blood albumen, otherwise it is treated like hog and sheep blood. The albumen is employed as a clarifying agent for sugar juices and also in the printing of fine colors on fabrics and calico printing. It is also made use of in the leather industry for clarifying tan liquors and for glazing leather.

A large part of the remainder of the offal is handled in what is known as the tank house. Entrails, stomachs and a host of miscellaneous and bony material are graded and subjected to hours of cooking in large tanks under steam pressure. When this process is complete the fat is drawn off from the top and furnishes the various grades of commercial tallow and grease. The tank water from the cooking is skimmed for grease and pumped to tanks, from which it is fed into vacuum evaporators and evaporated to a thick consistency, thus retaining all soluble organic matter resulting from the digestion. This substance is technically known as stick, and a further treatment with copperas and subsequent drying over steam rolls convert it into the so-called concentrated tankage which has a high nitrogen content. The solid residue left in the tanks is pressed in hydraulic presses to remove excess moisture and to recover as much of the fatty matter as possible. It is then dried and forms the various tankages which are so valuable for their nitrogen and phosphoric acid content in the manufacture of fertilizer. At some places this dried tankage is treated with naphtha in a grease extraction plant and practically all of the fat recovered. In the handling of these various products and in their further working up into the different commercial forms great aid has been obtained from the scientific knowledge available in this age.

An important branch of the offal production is the casing department. The intestines from cattle, sheep and hogs, as well as the hog stomachs and the bladders, are here prepared for the market. The chief use for the casings is, of course, in the manufacture of sausage and the stomachs are used as containers for head cheese. Gold beater's skins are derived from the inner membrane of the large intestine of cattle. Bladders find use as sausage containers, tobacco pouches, and as receptacles for putty and containers for lard for export to Europe.

Another growing department, which is dependent upon offal for its material, is that of the stock foods. For these products the better portions of the offal are utilized, such as blood, the pressed residues from the rendering of lard and





edible tallow, known as cracklings, and various scraps of meat. The different brands of poultry food consist chiefly of crushed bones, beef scraps, and cracklings. Other products are blood flour, meat meal and digester tankage. The last is an excellent food for fattening hogs, and is guaranteed to contain 60 per cent of protein, a nitrogenous material of great importance in the animal economy. It is made from high grade tankage.

We come now to the bones, which are the source of raw material for numerous products. The careful grading of the raw bones has made possible a very extended and diverse use. The best bones are the shin, blade, and cannon bones, out of which are manufactured many useful articles and various handles, buttons, pipe stems, dice, poker chips, mustard spoons, combs, and the like. Poorer grades find their chief use in fertilizer, where they furnish bone phosphate of lime, which on account of the phosphoric acid it contains, is extremely necessary in the plant for the formation of good grains and seeds. The bone for this purpose is steamed and ground or made into meal. Sometimes it is acidulated with sulphuric acid, which decomposes the tricalcium phosphate into mono and dicalcium phosphates; these are more readily available for plant food because they are soluble products.

Bones are often extracted with benzine and the fatty matter used for soap stock. They still contain nitrogenous organic bodies and when distilled in iron retorts yield volatile products, ammonium salts and bones or Dippel's oil. The aqueous liquor contains a number of chemical substances, ammonium carbonate, cyanide, sulphocyanide and sulphide, and is treated like gas liquor for the recovery of ammonia. The crude bone oil, if heated to high temperatures, gives ammonium carbonate and cyanide and leaves a tar which is the basis of commercial Brunswick black. There has been but little technical use found for the many constituents of bone oil, but they are used in Europe for denaturing alcohol and for making certain antiseptics. In this country these fields have not been gone into to any extent. Another product of value obtained from bones is bone black. This is the residue from the distillation; it forms about 65 per cent of the original bones and consists of free carbon and phosphate and carbonate of lime. It is employed as a decolorizing agent for sugar solutions, glucose, glycerine, oils, paraffine and for case-hardening iron. It can be revivified when it has lost its powers and used many times until it finds its way into fertilizer. Still another product of importance is the phosphorous for the match industry. Bone ash is still a source of raw material for this, though mineral phosphates have come into use as they are cheaper. The packers, however, are not engaged in manufacturing these side lines.

Continuing the discussion of the utilization of the so-called waste materials, we must not neglect the making of glue. The stock which serves as a basis for this product comes from hide trimmings, sheep skin trimmings, tendons, bones, horn piths, and cattle feet. A very valuable lubricating oil for fine machinery is secured by cooking cattle and sheep feet. This oil is called neatsfoot oil, and is nearly neutral. After the removal of the oil the bones are cooked again for the gelatinous material which they contain. The uses of the finished product are too well known to need any comment other than to call attention to less well known uses, namely, the manufacture of sand paper, emery wheels, the sizing of paper and the molding of various ornamental articles and toys. There is one edible product made in this field, and that is edible gelatine, which chemically is the same as glue, the only difference being that it is made under sanitary conditions and from selected calf stock.

Mention was made previously of the tallows and greases obtained in the operations of the tank house—let us now

DOCTORS OF CIVILIZATION

¶ The next mid-month number of the Scientific American, which will bear the date July 13, will be devoted in part to the sanitary engineer and his work.

¶ The modern sanitary engineer is the doctor of civilization. To him is entrusted the health of whole communities. The story of his activities is so new that some of its most interesting aspects have not been disclosed to the general public.

¶ No scientific discovery has proved of more practical value in the development of civilization than the fact that most diseases are caused by bacteria—that uncleanliness and microbes are synonymous terms; and no scientific discovery has proved more startling than the fact that the methods of transmitting microbes are innumerable. Flies, fleas, insects of all kinds, rats and other living animals have proven to be not simply uncomfortable pests, but the most dangerous enemies of mankind. They are the transmitters of bacteria—natural inoculators of disease. To fight them is one great problem of the sanitary engineer, a problem which will be simply discussed in the July mid-month number of the Scientific American under the title "Insects and Disease."

¶ Sewage and its disposal affects not simply the community at large, but the individual house owner as well. The present method of polluting streams and harbors with drainage will soon be obsolete. How that is slowly being accomplished will be revealed by Prof. Phelps of the Massachusetts Institute of Technology.

¶ There will be other articles on sanitation in the mid-month number of the Scientific American. Some of them will deal with sanitation, others with those timely scientific subjects which it is the mission of the Scientific American to describe in its own simple and accurate way.

¶ The number will be found on all newsstands. Price 15 cents.

consider the ultimate uses to which these are put. The rendered hog fat is pressed at low temperatures in a manner similar to the pressing of oleo oil. The lard oil thus obtained varies in neutrality from nearly neutral to 25 per cent free fatty acids, according to the stock used. In the woolen industry the better grades are used for oiling the wool in order that it may be spun with greater facility. The stearine which remains from the pressing of the oil is used for making soap. Tallow is also pressed and an acidless tallow oil made which is used as a lubricant.

A rather recent development in the oil and fat industry is the distillation of fatty acids. In this process the fat is split into its components, fatty acids and glycerine, by means of small quantities of suitable reagents known as catalysors. These may be oxides of certain metals, enzymes from certain seeds, and complex organic chemical compounds. The glycerine water is drawn off and the glycerine recovered. It is known as saponification crude. The fatty acids are distilled in iron stills with superheated steam. They find use in the manufacture of soap and candles. Cement makers buy stearic acid which they convert into lime soap for use as a water proofing compound for cement.

The great bulk of the tallow and grease recovered in a packing plant is consumed in the making of the numerous soaps and powders whose ever increasing volume is a good index of the advance of civilization. To understand properly another by-product which is obtained from the making of soap it is necessary to describe briefly the operation of soap boiling. The melted fat is pumped into large kettles having both open and closed steam coils, and the required lye is added and the boiling begun. What takes place in the kettle is this: The alkali decomposes the fat, unites with the fatty acids forming the soap, and freeing the glycerine which remains in the lye. This is then pumped to the glycerine plant.

For the recovery of the glycerine the lyes are neutralized, clarified and filtered, and then evaporated in a vacuum evaporator until a solution is obtained containing 80 per cent or more of glycerine. This is known as crude glycerine. It is next subjected to distillation with superheated steam when glycerine of high purity is obtained, the so-called dynamite glycerine which is used in the manufacture of various explosives. The chemically pure glycerine which is in use in pharmacy and for cosmetic purposes is made by redistilling and bleaching the dynamite glycerine. Other uses for these products are found in the preparation of printers' ink rolls and as anti-freezing mixtures for automobiles and fire extinguishers. The preservation of tobacco, the manufacture of confectionery and the preserving industry also require this product.

Of minor importance in the field of by-products are the pharmaceutical preparations, which in an article of this character deserve description. Perhaps the most important of these is pepsin. This is prepared from the inner lining of hogs' stomachs by digestion with dilute hydrochloric acid; the solution is strained or filtered and evaporated under vacuum to a syrupy liquid which is spread upon glass plates to dry. Its chief use is in medicine in cases of failing digestive powers of the stomach, where it serves the purpose of supplying the natural digestive ferment. Another preparation obtained from stomachs is rennet, which is extracted from the dried stomach of calves. It is used for curdling milk and in medicine.

The treatment of certain diseases by the administration of thyroid gland and its extracts is one of the satisfactory examples of therapeutic progress. This gland is found in the neck of animals, and for use in medicine that of the sheep is taken. The thymus gland is another neck gland whose extract is used in the treatment of goiter.

The pancreas furnishes another product, namely, pancreatin, which is a mixture of enzymes naturally existing in the pancreas of animals. It has been used in diabetes, but without as yet satisfactory results. It is also used for emulsifying fats like cod liver oil, for predigestive foods and in the treatment of different forms of dyspepsia.

Recently the suprarenal capsules of animals, which are located at the top of the kidneys, have been shown to contain a body which possesses a powerful action on the organism. Extracts are made from these glands of the sheep and ox and put on the market as adrenaline, which is used in controlling hemorrhages and for local effects on the blood vessels.

The extract of the pituitary body, which is situated in the brain, has been prepared, and is used in medicine on account of the changes which it produces in the circulation.

Still another product that can be classed here is ox gall, although its use in medicine is on the decline. It is employed, however, to a slight extent in the arts for insuring the uniform spreading of water colors on paper. It is also used for mordanting in the dyeing industry. As it possesses emulsifying powers similar to soap some of it finds use for cleaning woolen goods. The gall stones are highly prized by the Chinese for medicinal purposes, and all obtained are exported to that country.

We have now made a review of the field of by-products as it is to-day in the modern packing house. This survey necessarily could not go into minute details nor could it be treated in an exhaustive manner. Sufficient has been indicated, however, to give the reader an acquaintance and some comprehension of the enormous development which has been achieved in this important industry.

Fire Waste in the United States

(Concluded from page 551.)

standards then in existence, suffers the loss of his property through fire spreading from a less carefully constructed building. Remove the real menaces and this second-class fireproof structure will be comparatively safe. Many of these older type of so-called buildings are reasonably free from the danger of fire from within, but they cannot withstand the greater heat that comes from a conflagration. One would think that if a man provided for immunity from fire within he was doing his entire duty, but until the general conditions change considerably, there must be structures that are not only proof against fire from within, but also conflagration proof. This calls for the very highest type of fireproof building.

Much has been written as to why such conditions prevail in the United States, why we are so far behind Europe in protection against fire in the construction of buildings. Mayor Carter H. Harrison of Chicago, at the last annual meeting of the National Fire Protection Association May 14th, in discussing the fire loss of Chicago with that of Berlin, and explaining that the loss in Berlin, a city of the same size, was but one-tenth that of Chicago, and that the maintenance of the Berlin fire department was in the same ratio, declared that the better building regulations and better constructed buildings of Berlin were due to the fact that the German city did not attain is present position after but seventy-five years of growth, which is the length of Chicago's life. He further said that Chicago could not possibly have attained its present size and importance as a city, if from the outset it had attempted to follow "these precautions which we at the present time recognize as necessary."

The Mayor's statement is the truth of the whole matter and this statement applies to every city in the United States. This country will have to plead guilty to the indictment of being a young country, a child, civically speaking, and that it is learning fire protection, proper building laws, etc., just like the child learns to walk. Not only has it been disastrous to be young and inexperienced, but the

EPICYCLIC TRAINS, which play an important part in toothed gearing, are ably described in Scientific American Supplement 1524. Price 10 cents. For sale by Munn & Co., Inc., and all newsdealers.

United States has had a further handicap along the line of reduced fire losses in a bounteous supply of natural resources that could easily be fabricated into dwelling places. The abundant supply of timber years ago is responsible in a great degree for the present conditions. It is also responsible for the great and rapid growth of this country into a prosperity that has never been equalled before. It is true as Mayor Harrison said, Chicago could not have attained her present size and prominence in seventy-five years under any other conditions. Timber is much easier turned into homes than stone.

Europe many years ago was compelled to turn to stone, simply because her timber supply had become practically exhausted. It was the law of necessity working out and it resulted in fireproof cities.

That the United States is rapidly approaching this condition, which was met years ago by Europe, is being made more manifest every day in the dwindling of our timber supply and the ever increasing cost of lumber. The economic conditions alone would, in years, give us brick, stone and concrete cities which would be as unburnable as those of Europe, but we are not waiting for these natural conditions alone to work out. The lesson of our tremendous fire losses has already burned deep in the public conscience and we have already started on the way toward types of buildings that are the safest from fire of any in all the world. It is reasonable to say that there is nowhere in Europe such completely fireproof buildings as may be found in American cities. The trouble is there are not sufficient of them to prevent conflagrations, but they are increasing in number every day.

The increase in the use of clay products and concrete materials in the United States has been phenomenal in the last ten years and there is every indication that the growth will continue at an even faster rate. In the decade, 1900 to 1910, the value of the cement manufactures in this country increased from $9,859,000 to $55,903,000, or nearly six fold; and the value of clay products from $74,487,000 to $158,942,000, or nearly double that of 1900. In the same period the value of the building stone increased from $28,635,000 to $71,106,000, nearly three times.

It is believed that there would have been still greater growth had the architects and builders of the country not been handicapped by a lack of knowledge concerning the strength and fire proofing and fire resisting qualities of some of the newer building materials such as concrete. Considerable information on this subject has since been supplied by the Federal Government and the work is still going on. The demand for such knowledge came first from the Federal engineers engaged in construction work. They represented to Congress that the United States Government was the owner of buildings valued at more than half a billion dollars and that twenty million dollars were spent each year in new buildings. They showed the necessity of not only absolutely fireproof buildings but also of buildings of such a character that they would be safe from general conflagrations. How well the Federal engineers have builded is seen in the statement that in the last twenty years, not more than $25,000 damage has been done to Federal buildings by fire. It must be remembered, however, that nearly all Federal buildings are isolated from other structures, which is decidedly in their favor. Another evidence of their great care in construction and fireproofing is seen in the building occupied by the United States Mint at San Francisco, which stood earthquake and fire of 1906 and came through both ordeals hardly scathed, although buildings burned and crumbled all about it.

The structural materials investigations of the Federal Government, which were under the general direction of Dr. Joseph A. Holmes, then with the Geological Survey, gave to the country its first accurate knowledge concerning the strength and fire resisting qualities of concrete and also

much advanced knowledge concerning the availability of clay products. The experiments were started at St. Louis, Mo., during the World's Fair, later moved to Norfolk, Va., where the Jamestown exposition was being held and were finally moved to Pittsburgh, Pa., to permanent laboratories where they are now being continued as a part of the work of the Bureau of Standards. While the experiments were made primarily in behalf of the United States Government as the largest constructor of buildings in the United States, the findings were made public in bulletins which have done much toward placing the United States to the fore in the construction of buildings that are really fireproof.

It might be said that as a general rule, but few buildings constructed more than ten years ago are absolutely fireproof. Many of them have some fireproof qualities, excellent in themselves, but you will find either a wooden framed elevator shaft, wooden stairways, or unprotected windows. The walls may be substantial and of brick, the floors of bricks in arches, but you will find a wooden door leading from the basement to a hallway filled with burnable material. Every few months one of these so-called fireproof structures burns to the ground and the public wonders.

The modern fireproof building is so constructed that if a fire does start in a room, it may burn the wooden furniture, but will die out before it can reach to another room. The fireproof building must have iron doors, concrete floors, steel and concrete stairways, steel elevator shafts and even steel elevators. Its windows must be protected.

There is evidence on every hand that great progress is being made in the United States in the rebuilding of our cities. Hardly a city council in a city of any size but has within the last few years taken up the problem of a new building code to conform to present day conditions. The Iroquois theater fire in Chicago with its 600 deaths was a terrible lesson to all theaters. In every new theater in the country you will find to-day fireproof arrangements that can be directly attributed to the lesson learned at the Chicago holocaust. The Collinwood schoolhouse fire in Ohio, a few years ago, in which more than 100 children were burned to death, has stamped its terrible lesson on practically every schoolhouse in the country, new or old.

The enormous fire loss continues, but the maximum will soon be reached if not already reached. It will not be long before the many improvements begin to tell in reduced losses, for the United States remedies conditions rapidly when her people learn the way.

The Lohmann Process

PROF. HERMAN J. LOHMANN'S discovery of a method to permanently protect ferric articles from corrosion makes it possible to apply to the surface of steel or iron a coating of any non-corrodible metal of the lead group or a combination of these metals. The process is exactly similar, so far as the apparatus needed is concerned, to the present hot dip galvanizing process. The article to be treated is thoroughly cleansed either by a sand-blast or in a pickle composed of sulphuric acid, etc., then washed and then placed in the so-called Lohmann bath, containing the chemicals used in his process. An immersion of from one half minute to two minutes is all that is necessary, and during that period the pores are thoroughly cleansed of oxygen and the amalgamating agent is deposited over the surface so that when it is dipped in the molten metal the pores are filled and an integral union or chemical weld is made between the surface of the article treated and the non-corrodible coating.

In the present methods—and there is scarcely an exception, if any—the protective metal forms a surface adherence only with the steel or iron which it is supposed to protect and the pores still contain the oxygen, which eventually eats out or

destroys the contact points with the protective metal, resulting in a gradual separation and the subsequent exposure of the steel or iron surfaces to the action of the atmosphere.

At present, also, the almost universal coating is zinc, which as a metal is brittle and disintegrates very rapidly under certain conditions and, of course, is not resistant to sulphurous or sulphuric acid fumes and vapors. The fabrication of a zinc-coated article has to be done very carefully and even then minute cracks and pin-holes develop, which eventually result in the corrosion of the article it covers.

Under the Lohmann process, however, the filling of the pores and the integral attaching of the coating overcomes many of the objections and defects of a zinc coating, and the Lohmann process can go so much further in the selection of a protective coating as to make it of the very greatest value to both the manufacturer and the consumer. By its use, lead, tin, zinc, aluminium and other members of the lead group, either singly or in combination, may be freely used and thus a coating to meet the requirements may be furnished. In other words, where a steel article is to be exposed to a sulphurous condition, the well-known resistance of lead to its action makes it possible to treat the article with a lead coating; and as a result of the large number of experiments during the past year, it is Prof. Lohmann's opinion that a coating composed of 100 parts of lead and 1 part of tin will entirely supersede the present zinc-coated article. This lead-tin coating has proved of especial value in sheet work, as it is as pliable as a piece of paper and is resistant to practically every known element that attacks steel or iron. Another combination, composed of 100 zinc, 4 lead and 1 tin, is used in various articles where extreme pliability is not needed and where a bright appearance is desired in the finished article. Of course, it is not as resistant to sulphurous fumes as straight lead, but resists to a very large degree these conditions.

The experiments that have been made in large manufacturing establishments, such as sheet mills, wire mills, etc., develop the fact that the use of the Lohmann process does not in any way reduce the output and, in fact, in most cases articles may be treated more rapidly than under the present hot dip galvanizing method, and there has never been a failure in securing penetration and integral union where the article has been passed through the Lohmann bath.

In so far as the operation of a Lohmann plant is concerned, the usual hot dip galvanizer will not know that he is pursuing any different course than in his old method. Therefore, no expert knowledge of chemistry is required to successfully lohmannize articles. The cost of the process depends almost entirely upon the character of the protective metals used.

The usual test for galvanized material is the one minute dipping in what is known as the Preece test, which is composed of sulphate of copper. This is not a true or proper test for lohmannized material because the thickness of the coating is materially reduced under the Lohmann process and a much longer life given to the article because of the penetration and the union. At the same time, where lead and tin are introduced, they are more resistant to sulphate of copper than spelter.

It has developed that there are two absolute tests only to be made. One is to etch the edge of the treated article and take a microphotograph. This will always show the absence of a line of demarkation and will show the presence of the coating metal in the pores of the article, if there be any. In photographing a galvanized article, the line of demarkation is always plainly shown. Where it is possible, it is always well to cut a channel in a lohmannized article, making cuts of one-hundredth of an inch in thickness and have them analyzed by a chemist. He will develop the presence of the coating material sometimes as deep as the fourth or fifth cut.

Tests for the Quality of Glue

As the glue made from Hyde trimmings, etc., contains the most glutin, which is the cementing principal of the glue, the handy man must be able to distinguish the Hyde glue from other varieties, if he would avoid the occasional failure of his joints. While the nature of glue makes it rather a question of mechanical tests as to the quality of a given sample, than of laboratory tests, yet there are laboratory tests which serve to determine the source and quality of the sample.

A weighed sample is laid for twenty-four hours in cold water (not over 60 deg. Fahr.), and at the expiration of that time the excess of water is poured off and the jelly is weighed, the weight taken is deducted from this amount, the remainder is divided by the weight taken, and the result is absorption. The amount of water which the sample will take up and the character of the jelly found, not only serve to indicate the source, but also the quality of the sample. Hyde glue takes up less water than other glue or gelatine and forms a very soft jelly which is rather difficult to weigh accurately.

As Hyde glue that has been twice dissolved and again dried is capable of drying out more thoroughly and of showing better water-assimilating properties on redissolving, than glue obtained by a single drying, the relative amount of moisture already in the sample should be estimated. This moisture is best estimated by subjecting a gramme of the coarsely granulated sample on a weighted watch glass to a temperature of 220 deg. Fahr. for one hour, weighing again, and computing the loss. Since the size of the granules makes considerable difference, care must be used always to have the granules of different samples about the same size.

The quantity of ash, like the color, fracture and transparency, may vary within wide limits, without affecting the quality of the glue, but the percentage of ash is given in the following results of some experiments by the writer, to show about what should be expected.

Water Absorption.	Appearance of Jelly.	Moisture, Per Cent.	Ash, Per Cent	Remarks.
11.56	firm	8.70	2.36	Bone Glue
9.07	firm	8.31	1.98	Hyde, twice dried
4.93*	nearly fluid	7.76	1.13	Hyde, once "
4.79*	"	14.50	1.06	Hyde " "
8.57	very firm	6.59		Hyde, twice "
6.94*	nearly firm	45.00	2.37	Hyde (?)
5.98	nearly fluid	16.00	2.38	Hyde
15.57	extremely firm	33.00	1.00	French gelatin

The samples having the water absorption figure starred, gave the greatest satisfaction in use, because they set very rapidly, and did not so completely dry out when exposed to a dry atmosphere that the furniture, etc., on which they were used, fell to pieces.

An Anniversary of Asphaltum

IT is just two hundred years ago that a Greek physician of the Imperial Prussian Court obtained a concession for working the large asphalt beds of Neufchatel, Switzerland, which at that time belonged to Prussia. But the enterprising physician had no luck, as he failed to arouse the interest of the financiers. It was much later, at the time of the discovery of the asphalt-beds near Seyssel, in 1812, that closer attention was paid to this mineral and preparations were made for its mining. Yet another twenty years elapsed before Count Sasseny succeeded in drawing the attention of builders and allied industries to this material.

Eugenic Marriages.—Dean Sumner's suggestion that ministers demand a health certificate as well as a marriage license was approved on May 27th by 200 Protestant clergymen in a meeting of the Federated Churches of the city. A resolution was adopted unanimously urging pastors to direct their energies toward creating public opinion that shall indorse the plan.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12650) W. W. S. asks: Please send me directions how to make a wet battery for ignition purposes on a 1½ horse-power gasoline engine, make and break spark. A. You will find full detailed plans for making a very powerful wet battery, the best we know for use in sparking a gas engine, in our SUPPLEMENT No. 792, price 10 cents. Six cells are sufficient to give a strong spark with a good coil. If the plates are lifted out when not in use, this battery will not waste when not in use.

(12651) F. V. M. should give his name and address, as we cannot undertake to answer unsigned communications. As he states he "is a contented subscriber," we will make an exception in his case, and we answer the query as follows: A. Because the inertia of the hammer head causes it to resist the tendency of the friction of the hammer handle to move it in the direction of the blow which causes the light handle to move. In consequence, the handle slides farther into the head before the velocity is checked and its energy transferred to the head. The striking hammer head, after making contact with the end of the handle, is quickly brought to rest, while its energy is transferred to the handle, which moves rapidly forward. At the other end of the handle, the energy of the handle is quickly transferred (through friction) to the hammer head, while the handle meanwhile advances into the head before its motion is checked.

(12652) S. E. B. asks: 1. Will you kindly explain what causes the recoil when a gun is fired: whether it be the actual explosion, or is it the air rushing into the barrel of the gun, after the bullet has formed a vacuum by leaving? A. A gun recoils when fired because there is an equal pressure exerted in all directions by the gas in the barrel. The law of Newton, "Action and reaction are equal and opposite in direction," expresses this fact. The powder exerts the same force backward on the gun that it does forward on the ball; and if the gun were of the same weight as the ball, and had a sharp point as the ball has, it would hurt the one firing it as the ball would. The gun is heavier and broad where it presses upon the shoulder, and so does not move so fast backward as the ball does forward. It does not therefore hurt the man so much. It is the actual explosion and pressure of the gas in the gun which causes the recoil, and not the air rushing into the gun. The air does not rush into the barrel as the ball leaves it, since the ball is driven out of the gun by the gas behind the ball. 2. Also, what causes the noise? A. The sound is caused by the sudden belching of so large a quantity of gas into the air, thus giving a powerful shock to the air.

(12653) E. E. B. asks: Kindly publish in Notes and Queries a formula for a bubble soap. I have been informed that bubbles can be blown that are lasting and can be handled. A. A good soap solution for blowing bubbles is made by dissolving the best Castile or Marseilles soap in water and adding glycerine. Take 1 part Castile soap, 20 parts water, and 15 parts of glycerine. All by weight. Our "Scientific American Cyclopedia of Formula," price $5, gives many formulas for this solution. We can also furnish you with C. V. Boys' book, "Soap Bubbles," price $1, which will be the best guide. Our SUPPLEMENT Nos. 160, 495, 563, 579, 831, 931, price 10 cents each, contains valuable articles upon this interesting topic. We have never seen a soap bubble which could be handled, although we have seen those which could be caught on the hand without breaking.

(12654) E. J. B. asks: Can you explain why a man feels no heavier at the poles than in the temperate zones or at the equator? In other words, how does the centrifugal force of gravity affect a man? The thing is this: there being no centrifugal force at the north or south pole, and the gravity is supposed to be the same, it seems that a man would have more weight at the poles than where the centrifugal force is great. If possible please explain as fully as you are able. A. A body weighs less on the equator than at the poles by reason of centrifugal force. The amount is not great, being 0.01112, or 1/289 part of his weight. Thus 289 pounds at the equator would at the pole weigh 290 pounds if weighed by a spring balance. This is not enough to be appreciable to anyone in their walking, or sense of their own weight. The force of gravity is also less at the equator than at the poles, because the surface of the earth is nearer the center of the earth at the poles by about 13 miles. The difference in weight for this reason is about 1/190 part, so that 190 pounds at the equator will weigh 191 pounds at the poles if weighed by a spring balance. The combined effect of the two causes is equal to their sum, since both affect weight in the same order. It is about 8.7 pounds in 1,000 pounds. You will find this in Young's "General Astronomy," price $3.05 postpaid.

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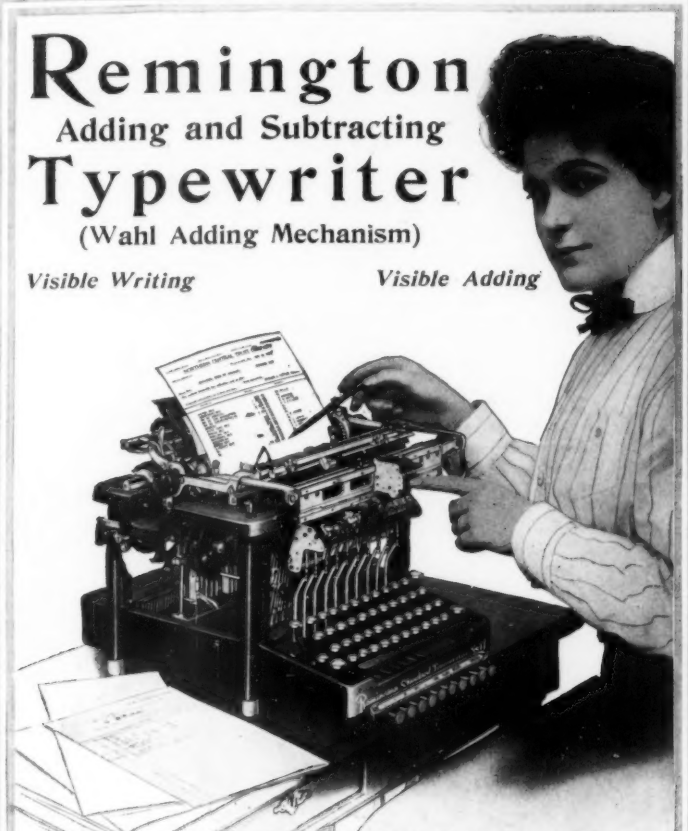

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THEIR DESIGN, CONSTRUCTION & OPERATION

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By **GROVER CLEVELAND LOENING, B.Sc., A.M.**

Aviation is a predominant topic in the mind of the public, and is rapidly becoming one of the greatest goals of development of the progressive engineering and scientific world. In the many books that have already been written on aviation, this fascinating subject has been handled largely, either in a very "popular" and more or less incomplete manner, or in an atmosphere f mathematical theory that puzzles beginners, and is often of little value to aviators themselves.

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PART II.

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